APPENDIX I

Chronological List of Comments, Comment Responses and Revisions

CHRONOLOGICAL LIST OF COMMENTS, COMMENT RESPONSES AND REVISIONS (all documents attached)	
Date	**Document**
10 December 2008	IDEQ Letter from Mr. Mike Rowe. Re: Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2 and 2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008
20 November 2008	MWH Letter from Mr. Cary Foulk. Re: P4 Production Response to November 3, 2008 Agency and Tribal Comments on Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2, 2007 Hydrogeologic Data Collection activities and Updated Conceptual Models*, July 2008.
3 November 2008	IDEQ Letter from Mr. Mike Rowe. Re: Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2 and 2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008
30 September 2008	MWH E-mail submission from Mr. William Wright. Rewrite of 2007 GW Report Conceptual Model Section
29 August 2008	IDEQ Letter from Mr. Mike Rowe. Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 2 and 2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008 (Transmits Agencies/Tribes comments on Revision 2.)
11 July 2008	MWH Letter from Mr. Cary Foulk and Mr. William Wright transmitting *Draft Interim Report for Hydrogeologic Investigation – 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models – Revision 2*, and Response to Comments on Revision 1.
10 June 2008	IDEQ Letter from Mr. Mike Rowe. Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 1 and 2007 Hydrogeologic Data Collection Activities and Update Conceptual Models,* April 2008 (Transmits Agencies/Tribes comments on Revision 1.)
16 April 2008	MWH Letter from Mr. Cary Foulk and Mr. William Wright transmitting *Draft Interim Report for Hydrogeologic Investigation – 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models – Revision 1*, and Response to Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 0 and 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models*, February 2008
14 March 2008	IDEQ Letter from Mr. Mike Rowe. Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 0* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models,* February 2008 (Transmits Agencies/Tribes comments on Revision 0.)
1 February 2008	MWH Letter from Mr. Cary Foulk and Mr. William Wright transmitting original *2007 Data Report and Conceptual Model Update, Phase II Groundwater Investigations at the Ballard, Henry, and Enoch Valley Mines*, February 2008.

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

10 December 2008

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008

Dear Mr. Koch,

The Agencies and Tribes (A/T) have reviewed the 20 November 2008 response by P4/Monsanto to A/T comments of 3 November 2008 on the proposed revision of Section 3.1.4. This section entitled "Conceptual Geochemical Model for Selenium Release and Groundwater Transport" is part of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models (2007 GW Reports)*, submitted by P4/Monsanto on 30 September 2008 pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). Resolution of previous comments, incorporation of the minor revisions listed below, and receipt of the appropriate pages for inclusion in Revision 2 should result in swift conditional approval of the *2007 GW Reports*. Final approval will occur upon receipt and review of the validated data.

To resolve Agency and Tribal concerns, P4/Monsanto must modify Section 3.1.4 per direction below.

- *Comment 3.6*. Page 2, Paragraph 2: The proposed text should be reworded to state that "Oxyhydroxides along with organic matter constitute a secondary source of selenium…"

- *Comment 3.8*. Page 2, Paragraph 3: This provides the clarification needed, thank you. Please incorporate the concepts discussed in the response into the text to support the statement in question, along with citing the Nicholson et al. paper, submitted after the RTCs.

- *Comment 3.9*. Page 3, Paragraph 1: Please incorporate the concepts discussed in the response into the text to support the statement in question.

Note also that there is additional EPA guidance (Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volumes 1 [EPA/600/R-07/139] and 2 [EPA/600/R-07/140]) on monitored natural attenuation, which you should consider for review.

To reiterate from the Agency/Tribal letter of 3 November 2008, Section 3.1.4 provides P4/Monsanto's conceptual site geochemical model for selenium release and groundwater transport for the Ballard, Henry, and Enoch Valley mine sites. We recognize that this is a preliminary conceptual geochemical model based on limited site-specific data. As such, the model will be updated and refined as additional information becomes available. We are willing to cooperate with you to scope work to support refinement of the geochemical CSM.

As the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008, are considered deliverables under the CO/AOC, per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." I will schedule time to talk about any questions you might have in regard to the Agency/Tribal comments during our next conference call. Anticipating that any concerns can be resolved on the conference call, the deadline for the next revision of the *2007 GW Reports* is 12 January 2009. Rather than reprint the many pages which do not require a change, please provide us a revised Section 3.1.4 and other pertinent pages for ultimate insertion in Revision 2.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

The Agencies and Tribes look forward to working with you to finalize this document as quickly as possible. Please let me know if you have any questions on the above.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Bill Wright (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman, Will Frymire (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
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File copy/Monsanto/Correspondence

MWH

BUILDING A BETTER WORLD

November 20, 2008

Mr. Mike Rowe
IDEQ
444 Hospital Way, #300
Pocatello, ID 83276

RE: P_4 Production Response to November 3, 2008 Agency and Tribal Comments on Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2, 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models*, July 2008.

Dear Mr. Rowe,

On behalf of P_4 Production, L.L.C. (P4), MWH is providing the following responses to the Agencies and Tribes comments on the above referenced document. P4 has responded to two issues identified in the cover letter in the second and third paragraphs. This is followed by responses to the comments contained in the attachment to the November 3 letter. Per the approach laid out by the Agencies and Tribes, and P4, the next step will be to have a conference call to address any issues that need further clarification or resolution. P4 will provide a revised document following the resolution of any remaining issues.

COMMENT RESPONSE

Agency/Tribal Cover Letter, Second Paragraph

"Overall, the Geochemical CSM appears to be factually correct in most cases; however, the direction of the section lacks focus. The section lists a large number of ways in which selenium may be transformed in the environment, resulting in either increased or decreased mobility, and some of the statements regarding mobility appear to be conflicting. What is ultimately needed is a more robust conceptual site geochemical model, with the most likely pathways from mine-affected areas to the groundwater and surface water systems. The most plausible geochemical reactions should be put forward and defended with site data where possible (or data from nearby sites), rather than listing all potential reactions. We recognize, however, that this is a preliminary conceptual geochemical model based on limited site-specific data. As such, the model will be updated and refined as additional information becomes available."

P4/Monsanto Response: We agree with much of this comment. Because it is a preliminary geochemical model, most of the relevant possible reactions and processes were listed. As site data are evaluated along with data from other phosphate mining locations, the model will be refined.

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Agency/Tribal Cover Letter, Third Paragraph

"The preliminary Geochemical CSM suggests that P4/Monsanto believes that natural attenuation of some contaminants is an important process that occurs in the subsurface.
We would like to emphasize that these processes must be quantified and supported with site data if P4/Monsanto wants the Agencies and Tribes to consider such information in remedy development and decision making. You may wish to review EPA policy and guidance on monitored natural attenuation (MNA; see Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Site, April 1999, Final OSWER Directive, EPAl540JR-991009). If you desire to further investigate MNA or if you believe MNA may be a component of a future cleanup alternative, then we recommend you begin to evaluate potential data needs to support such an analysis. If data needs or gaps are identified (additional site-specific data, geochemical studies or tests), then you will need to develop sampling and analysis plans to guide that work. We are willing to cooperate with you to scope work to support refinement of the geochemical CSM. This type of planning effort should be initiated soon to prevent delays in the project schedule in the future."

P4/Monsanto Response: P4/Monsanto appreciates the agencies comment and apparent willingness to consider MNA under the right conditions. At this time MNA is not identified as a potential remedial alternative with a specific application identified rather a process that may occur. However, if it is identified as a potential remedial option given the results of the nature and extent investigation, it may best be addressed through a Treatability Study. In this way it would be treated similar to other potential remedial alternatives where the effectiveness needs to be documented.

Specific Agency/Tribal Comments

Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models,* July 2008

General Comments

"2-A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document (e.g., in an appendix)."

P4/Monsanto Response: For this revision the agencies and tribes have requested that a revised Section 3.1.4 be submitted only. However, P4/Monsanto will also submit this comment response document and previous comments and comment responses for the document as an appendix. P4/Monsanto will provide this appendix as Appendix I, which can be attached to the report. In addition, a replacement page iv (List of Appendices) will be provided, listing Appendix I.

"2-B. The conceptual geochemical models seem reasonable. However, like all conceptual models, they must be refined and verified as more data become available. A narrative linking and

describing how well the model compares to observed conditions at the mines and identifying discrepancies is missing. The Agencies and Tribes require the 2008 Groundwater Reports to include this linkage and identification of discrepancies."

P4/Monsanto Response: Comment acknowledged. The water typing analysis previously requested by the agencies and tribes has provided some insight into the geochemical processes operating at the mines. This information will be provided in the 2008 Data Summary Report in context of the Geochemical CSM.

"2-C. In future reports (e.g., 2008 Groundwater Reports), the cross-sections provided for the three mines should include the conceptual potentiometric surface for each aquifer system as inferred or determined from previous data and data presented in this report."

P4/Monsanto Response: Comment acknowledged. When provided, cross sections will include measured and/or conceptual potentiometric surfaces as appropriate.

Previous Comments

"1-3. Page 18, Table 2-1, Row 2 -Based on the description of MMW008 on page 11 and the drilling log and well completion diagram for MMW008 in Appendix A, it appears that the formation at screen is Dinwoody not alluvium and Dinwoody. Please revise for future reports."

P4/Monsanto Response: Comment acknowledged. The confusion may in part arise because the well is installed in the uppermost weathered Dinwoody Formation. Therefore, geologically it is in fact installed in the Dinwoody Formation. However, this weathered bedrock is in direct hydrologic connection with the alluvial unit and functions as a continuation of the alluvial groundwater system. Therefore, the alluvium and upper weathered bedrock units are considered to be one hydrogeological unit. This hydrogeological unit has been termed the alluvial system and has a local hydrogeologic extent. This is in contrast to the Dinwoody Formation bedrock hydrogeologic unit, which typically has an intermediate extent, and the Wells Formation hydrogeologic unit of regional extent. This distinction will be clarified in future reports and any inaccurate representation of the well corrected.

New Comments

"3-1. Page 42, Section 3.1.4 - Insert the revised Section 3.1.4 as forwarded to the Agencies and Tribes in a 30 September 2008 e-mail from Bill Wright with the following changes."

> **3.2. Page 1, Paragraph 2:** "All rocks contain concentrations of most of the naturally occurring elements of the periodic table."
>
> **Agency/Tribal Comment:** 'This statement is misleading and overly broad, it is suggested that the sentence be reworded to read "Most rocks contain concentrations of many naturally occurring elements." Please revise.'

P4/Monsanto Response: The section will be revised as requested.

3.3. Page 1, Paragraph 4: "These USGS data from sections in the mine areas are similar to selenium concentration data that has been collected from waste rock in the Enoch Valley mine dumps as part of studies sponsored by the Idaho Mining Association (unpublished data)."

Agency/Tribal Comment: "Were not these data part of the *Enoch Valley Mine Waste Rock Dump Characterization?* If so, please reference accordingly. If not, the Agencies and Tribes do not feel it appropriate to cite data which we have not had the opportunity to review. Please revise accordingly."

P4/Monsanto Response: This sentence has been deleted. This is the data that has been collected as part of the drilling program completed by TetraTech. We understand that the report containing the data was provided to the agencies, but not reviewed.

3.4. Page 1, Paragraph 4: "The USGS also conducted studies of element leaching from the same rock descried in Heming and Grauch, 2004."

Agency/Tribal Comment: 'The term "descried" should be 'described' and "element leaching" should possibly be elemental leaching, elements leaching, or some other terminology. Please revise.'

P4/Monsanto Response: The typo has been corrected. The term "element leaching" has been changed to "elemental leaching".

3.5 Page 2, Paragraph 2: "However, geochemical studies of the Phosphoria Formation also indicate that a portion of the total selenium content occurs outside of these identified mineralogical reservoirs (Maxim, 2002), and studies suggest that there is a source of readily soluble selenium in relatively unweathered Meade Peak member rocks that can be released by short-term leaching (24 hour) even under anoxic conditions (Herring, 2004)."

Agency/Tribal Comment: "This statement infers (to some readers) that selenium would leach into groundwater even without mining disturbance. This may be true, but selenium concentrations in groundwater samples outside of the mine-affected areas should be cited to demonstrate this. Also, it is clear that mine areas contain concentrations elevated well above background, so this statement can be viewed as misleading. The work cited (Heming, 2004) reported that for a limited number of core samples run under anaerobic conditions, selenium was leached from least-altered samples either the same or slightly less than under oxidizing conditions. The key appears to be whether or not the rock is subjected to leaching; clearly mining disturbance and production of waste piles would enhance exposure to leach water. Please revise accordingly."

P4/Monsanto Response: The following statement has been added to the paragraph to focus the discussion on disturbed rock – "Such selenium may be released at a higher than background rate when the permeability of the rock mass is increased due to disturbances like mining".

3.6. Page 2, Paragraph 2: "Iron oxyhydroxides are indicated as a reservoir for selenium in unweathered or minimal weathered Meade Peak rocks (Perkins and Foster, 2004)."

Agency/Tribal Comment: "This is incorrect - it should read weathered rocks - iron oxyhydroxides are minimal or absent in unweathered clays of the Meade Peak. Review the cited work's abstract and revise accordingly."

P4/Monsanto Response: Quoting from the abstract of the document in question – "In unweathered samples, sulfides (mainly pyrite and sphalerite) host the majority of Cd, Cu, Se and Zn and a large portion of the Ni and V. Most of the non-sulfide fraction of these elements in unweathered samples is associated with the organic matter and oxyhydroxides." Sulfides are indicated as the primary reservoir, but oxyhydroxides are indicated as a secondary reservoir. Even if the concentration associated with the oxyhydroxides is lower, but this selenium is readily released, it could represent an early source of released selenium from unweathered rock. The statement in Section 3.1.4 in question incorrectly identifies the oxyhydroxides as "iron oxyhydroxides". This was an inappropriate assumption and will be corrected. The statement in the text will be revised to more accurately and clearly cite the conclusion of the referenced paper. The revised text reads:

"Oxyhydroxides are indicated as a secondary reservoir for selenium in unweathered or minimal weathered Meade Peak rocks, with sulfide as the primary reservoir (Perkins and Foster, 2004)."

3.7. Page 2, Paragraph 3: "It appears possible that the readily soluble forms of selenium, likely adsorbed selenite or selenate ions, are the most significant contributor to elevated aqueous selenium concentrations associated with the phosphate mining waste, and that the less soluble forms contribute less selenium."

Agency/Tribal Comment: The point was made earlier in the section that unweathered rocks leach the most selenium – adsorbed selenite or selenate ions would be found in significantly weathered rocks, which contributed the least selenium in leach tests. Explain the reasoning more clearly, or alter the statement.

P4/Monsanto Response: The basic statement is correct in the soluble selenium will be more readily released to the environment than less soluble selenium, but the contradiction identified in the comment is noted. A possibility is that the absorption sites in the weathered rock are more generally in equilibrium with near surface aqueous conditions. The absorption sites in fresh rock are not, and therefore the selenium is more easily released. The statement in Section 3.1.4 also fails to consider the time component. It may

very well be that in the short term the readily soluble selenium represents the more significant source, but over the long term slow oxidation of the sulfide may release more selenium mass. However, because release is slower, the concentrations observed in the environment may be lower. This is a common observation with mining wastes – the so called first flush phenomena. This concept will be further flushed out in future revisions to the conceptual model. In the mean time, it is proposed that the statement in question be revised as follows:

"It appears possible that the readily soluble forms of selenium, likely adsorbed selenite or selenate ions, are the most significant contributor to elevated aqueous selenium concentrations associated with the phosphate mining waste, and that the less soluble forms contribute less selenium in the near term following waste rock deposition." (Underline not to be included in revised document.)

3.8. Page 2, Paragraph 3: "This in part may be due to sufficient neutralizing capacity in the waste rock, which inhibits the formation of the widespread acidic and biological conditions that enhances sulfide oxidation reactions."

Agency/Tribal Comment: The source or reasoning behind this statement is not clear. Sulfide oxidation does not require low pH, but rather low pH can result from the oxidation. If hydrogen ions released into solution by the sulfide oxidation are neutralized by the waste rock, it would tend to drive the oxidation reaction forward rather than inhibit the reaction. Explain the reasoning more clearly, or alter the statement.

P4/Monsanto Response: In a strictly abiotic (non-biological) environment the stoichiometric controls indicated in the comment may play a role. However, the conditions surrounding the development of acid rock drainage (ARD) are more complex, but they are also very well studied (e.g., Alpers and Blowes, 1994)*. There are a number of ways a circum-neutral environment can slow sulfide oxidation. Most importantly, ARD generation is a process that occurs much more rapidly in the presence of catalyzing bacteria (e.g., *Thiobacillus ferrooxidans*), which only thrive in the low-pH environments. Another notable factor is that ferric iron (Fe^{3+}) will also oxidize pyrite, even in the absence of oxygen. In alkaline conditions the ferric iron will readily precipitate and a secondary mineral, such as ferric hydroxide. However, under acidic conditions the ferric ion will remain in solution and be available to oxidize additional pyrite further advancing ARD formation. In addition, the secondary iron minerals that precipitate in the neutral environment may coat sulfide grains limiting oxygen and water availability for further oxidation.

It is proposed that if this explanation is not sufficient to address this comment, a more detail discussion of the ARD process and the associated release of selenium from sulfides be included in the next iteration of the conceptual model in a future submittal.

* Alpers, C.N., and Blowes, D.W., 1994. *Environmental Geochemistry of Sulfide Oxidation*. ACS Symposium Series 550, American Chemical Society, Washington D.C., 681 p.

3.9. Page 3, Paragraph 1: "However, if the interior of the mine dump is oxygen deficient, it is possible for selenium to be reduced and become less mobile and be retained in the dump environment through adsorption or precipitation."

Agency Comment: This is in contrast to the statement made in the Comment 3.5 above) that "readily soluble" selenium occurs in unweathered, more reduced forms of the formation. Explain the reasoning more clearly, or alter the statement.

P4/Monsanto Response: Here again the biological component needs to be considered. In the oxygen deficient environment and in the presence of a source of organic carbon, reducing bacteria may change the selenium to more reduced, less mobile phases. In this case, it is returning to an environment more similar to it in situ condition prior to mining or similar to the environment in which the selenium became initially enriched in the Phosphoria Formation. This is in contrast to fresh rock being flushed with oxygenated water in the absence of reducing bacteria.

3.10. Page 3, Paragraph 2: 'The sorption and oxidation/reduction processes for selenium have been studied. Selenium occurs as three principal species in oxygenated water: selenite ($Se0_3^{2-}$), biselenite ($HSe0^{3-}$) and selenate ($Se0_4^{2-}$) (Neal, 1990; Hem, 1989)."

Agency /Tribal Comment: The phrase "in oxygenated water" should be changed to "under oxidizing conditions and typical groundwater pH" for the sentence to be correct. Please revise.

P4/Monsanto Response: The revision will be made.

3.11. Page 3, Paragraph 3: "Assimilatory reduction of selenium occurs when sulfate-reducing bacteria incorporate selenide as a trace nutrient. Sulfate reducing bacteria are also able to reduce selenium oxyanions to elemental selenium by abiotic, but biologically mediated pathways (Hockin and Gadd, 2003)."

Agency/Tribal Comment: Rather than listing all of the possible transformations of selenium in nature, the discussion should be limited to the most likely pathways in mine-affected areas. For example, describe how and where sulfate-reducing conditions would occur along the flowpaths from the waste piles. This does not appear to be likely, given oxygenated water leaching of the waste rock. This narrowing of the focus of the Geochemical CSM to most likely pathways can be addressed in the 2008 Groundwater Reports.

P4/Monsanto Response: Comment noted. Future presentation and discussion of the geochemical CSM will provide the additional detail requested.

3.12. References: There are sources (e.g., Cowan et al., 1990, Herring and Grauch, 2004) cited in the text that are not included in the references. Please include references for all sources cited.

P4/Monsanto Response: This oversight will be corrected.

CLOSING

As noted in the opening, if the Agencies and Tribes agree that these responses are acceptable, P4 will provide a revised document incorporating the changes outlined above. If there are any remaining issues associated with the comment responses that need further resolution or clarification, we would welcome discussing them in a conference call per the agreed upon comment response procedure. If there is a need for a call please contact Barry Koch. Otherwise, with your approval, we will submit the revised section and a comment response appendix. Please note that the November 3, 2008 letter from the Agencies and Tribes requires P4 to submit a document revision within 30 days of the receipt of comments. This deadline will need to be extended unless P4 receives approval of this comment response before the Thanksgiving holiday.

If needed, we look forward to discussing this response with you and appreciate your thought and input regarding the geochemical conceptual model.

Sincerely,

MWH Americas, Inc.

Cary L. Foulk
Project Manager
Supervising Geologist and Geochemist

cc: Barry Koch, P4 Production
Dean Brame, MWH
File

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

3 November 2008

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: Revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008

Dear Mr. Koch,

The Agencies and Tribes (A/T) have reviewed the proposed revision of Section 3.1.4 of the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models (2007 GW Reports)*, submitted by P4/Monsanto on 30 September 2008 pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). Section 3.1.4 (referred to as the Geochemical CSM throughout the rest of this letter) provides P4/Monsanto's conceptual site geochemical model for selenium release and groundwater transport for the Ballard, Henry, and Enoch Valley mine sites in southeastern Idaho. Only the proposed revision to Section 3.1.4 was submitted to the A/T on 30 September 2008 in order to obtain A/T comments on the updated Geochemical CSM prior to submittal of P4/Monsanto's next version of the *2007 GW Reports*.

Overall, the Geochemical CSM appears to be factually correct in most cases; however, the direction of the section lacks focus. The section lists a large number of ways in which selenium may be transformed in the environment, resulting in either increased or decreased mobility, and some of the statements regarding mobility appear to be conflicting. What is ultimately needed is a more robust conceptual site geochemical model, with the most likely pathways from mine-affected areas to the groundwater and surface water systems. The most plausible geochemical reactions should be put forward and defended with site data where possible (or data from nearby sites), rather than listing all potential reactions. We recognize, however, that this is a preliminary conceptual geochemical model based on limited site-specific data. As such, the model will be updated and refined as additional information becomes available.

The preliminary Geochemical CSM suggests that P4/Monsanto believes that natural attenuation of some contaminants is an important process that occurs in the subsurface. We would like to emphasize that these processes must be quantified and supported with site data if P4/Monsanto wants the Agencies and Tribes to consider such information in remedy development and decision making. You may wish to review EPA policy and guidance on monitored natural attenuation (MNA; see *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Site,* April 1999, Final OSWER Directive, EPA/540/R-99/009). If you desire to further investigate MNA or if you believe MNA may be a component of a future cleanup alternative, then we recommend you begin to evaluate potential data needs to support such an analysis. If data needs or gaps are identified (additional site-specific data, geochemical studies or tests), then you will need to develop sampling and analysis plans to guide that work. We are willing to cooperate with you to scope work to support refinement of the geochemical CSM. This type of planning effort should be initiated soon to prevent delays in the project schedule in the future.

To resolve Agency and Tribal concerns stated in this letter, P4/Monsanto must modify Section 3.1.4 per our direction below. Some of our comments may be deferred and addressed when the geochemical CSM is refined in the interim report for 2008 hydrogeologic investigations. We have identified these in the attachment. The remaining comments must be addressed now. Previous comments from the letter of 29 August 2008 that were not resolved are also included.

As the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008, are considered deliverables under the CO/AOC, per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." Rather than reprint the many pages which do not require a change, please provide us a revised Section 3.1.4 for ultimate insertion in Revision 2 by 3 December 2008. Modification as directed will result in conditional approval of these documents. Final approval will occur upon receipt and review of the validated data.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

The Agencies and Tribes look forward to finalizing the *2007 Groundwater Reports*. Please let me know if you have any questions.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

Enclosure

cc: Robert Geddes (P4/Monsanto)
Bill Wright (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman, Will Frymire (C-TNF)
Jason Sturm (BLM)
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Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008

General Comments

2-A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document (e.g., in an appendix).

2-B. The conceptual geochemical models seem reasonable. However, like all conceptual models, they must be refined and verified as more data become available. A narrative linking and describing how well the model compares to observed conditions at the mines and identifying discrepancies is missing. The Agencies and Tribes require the 2008 Groundwater Reports to include this linkage and identification of discrepancies.

2-C. In future reports (e.g., 2008 Groundwater Reports), the cross-sections provided for the three mines should include the conceptual potentiometric surface for each aquifer system as inferred or determined from previous data and data presented in this report.

Previous Comments

1-3. Page 18, Table 2-1, Row 2 – Based on the description of MMW008 on page 11 and the drilling log and well completion diagram for MMW008 in Appendix A, it appears that the formation at screen is Dinwoody not alluvium and Dinwoody. Please revise for future reports.

New Comments

3-1. Page 42, Section 3.1.4 – Insert the revised Section 3.1.4 as forwarded to the Agencies and Tribes in a 30 September 2008 e-mail from Bill Wright with the following changes.

> **3.2. Page 1, Paragraph 2:** "All rocks contain concentrations of most of the naturally occurring elements of the periodic table."
> **Agency/Tribal Comment**: This statement is misleading and overly broad; it is suggested that the sentence be reworded to read "Most rocks contain concentrations of many naturally occurring elements." Please revise.
>
> **3.3. Page 1, Paragraph 4:** "These USGS data from sections in the mine areas are similar to selenium concentration data that has been collected from waste rock in the Enoch Valley mine dumps as part of studies sponsored by the Idaho Mining Association (unpublished data)."
> **Agency/Tribal Comment:** Were not these data part of the *Enoch Valley Mine Waste Rock Dump Characterization*? If so, please

reference accordingly. If not, the Agencies and Tribes do not feel it appropriate to cite data which we have not had the opportunity to review. Please revise accordingly.

3.4. Page 1, Paragraph 4: "The USGS also conducted studies of element leaching from the same rock descried in Herring and Grauch, 2004."
Agency/Tribal Comment: The term "descried" should be 'described' and "element leaching" should possibly be elemental leaching, elements leaching, or some other terminology. Please revise.

3.5 Page 2, Paragraph 2: "However, geochemical studies of the Phosphoria Formation also indicate that a portion of the total selenium content occurs outside of these identified mineralogical reservoirs (Maxim, 2002), and studies suggest that there is a source of readily soluble selenium in relatively unweathered Meade Peak member rocks that can be released by short-term leaching (24 hour) even under anoxic conditions (Herring, 2004)."
Agency/Tribal Comment: This statement infers (to some readers) that selenium would leach into groundwater even without mining disturbance. This may be true, but selenium concentrations in groundwater samples outside of the mine-affected areas should be cited to demonstrate this. Also, it is clear that mine areas contain concentrations elevated well above background, so this statement can be viewed as misleading. The work cited (Herring, 2004) reported that for a limited number of core samples run under anaerobic conditions, selenium was leached from least-altered samples either the same or slightly less than under oxidizing conditions. The key appears to be whether or not the rock is subjected to leaching; clearly mining disturbance and production of waste piles would enhance exposure to leach water. Please revise accordingly.

3.6. Page 2, Paragraph 2: "Iron oxyhydroxides are indicated as a reservoir for selenium in unweathered or minimal weathered Meade Peak rocks (Perkins and Foster, 2004)."
Agency/Tribal Comment: This is incorrect – it should read weathered rocks - iron oxyhydroxides are minimal or absent in unweathered clays of the Meade Peak. Review the cited work's abstract and revise accordingly.

3.7. Page 2, Paragraph 3: "It appears possible that the readily soluble forms of selenium, likely adsorbed selenite or selenate ions, are the most significant contributor to elevated aqueous

selenium concentrations associated with the phosphate mining waste, and that the less soluble forms contribute less selenium."
Agency/Tribal Comment: The point was made earlier in the section that unweathered rocks leach the most selenium - adsorbed selenite or selenate ions would be found in significantly weathered rocks, which contributed the least selenium in leach tests. Explain the reasoning more clearly, or alter the statement.

3.8. Page 2, Paragraph 3: "This in part may be due to sufficient neutralizing capacity in the waste rock, which inhibits the formation of the widespread acidic and biological conditions that enhances sulfide oxidation reactions."
Agency/Tribal Comment: The source or reasoning behind this statement is not clear. Sulfide oxidation does not require low pH, but rather low pH can result from the oxidation. If hydrogen ions released into solution by the sulfide oxidation are neutralized by the waste rock, it would tend to drive the oxidation reaction forward rather than inhibit the reaction. Explain the reasoning more clearly, or alter the statement.

3.9. Page 3, Paragraph 1: "However, if the interior of the mine dump is oxygen deficient, it is possible for selenium to be reduced and become less mobile and be retained in the dump environment through adsorption or precipitation."
Agency Comment: This is in contrast to the statement made in the Comment 3.5 above) that "readily soluble" selenium occurs in unweathered, more reduced forms of the formation. Explain the reasoning more clearly, or alter the statement.

3.10. Page 3, Paragraph 2: "The sorption and oxidation/reduction processes for selenium have been studied. Selenium occurs as three principal species in oxygenated water: selenite (SeO32-), biselenite (HSeO3-) and selenate (SeO42-) (Neal, 1990; Hem, 1989)."
Agency /Tribal Comment: The phrase "in oxygenated water" should be changed to "under oxidizing conditions and typical groundwater pH" for the sentence to be correct. Please revise.

3.11. Page 3, Paragraph 3: "Assimilatory reduction of selenium occurs when sulfate-reducing bacteria incorporate selenide as a trace nutrient. Sulfate reducing bacteria are also able to reduce selenium oxyanions to elemental selenium by abiotic, but biologically mediated pathways (Hockin and Gadd, 2003)."
Agency/Tribal Comment: Rather than listing all of the possible transformations of selenium in nature, the discussion should be limited to the most likely pathways in mine-affected areas. For

example, describe how and where sulfate-reducing conditions would occur along the flowpaths from the waste piles. This does not appear to be likely, given oxygenated water leaching of the waste rock. This narrowing of the focus of the Geochemical CSM to most likely pathways can be addressed in the 2008 Groundwater Reports.

3.12. References: There are sources (e.g., Cowan et al., 1990, Herring and Grauch, 2004) cited in the text that are not included in the references. Please include references for all sources cited.

William E Wright/User/Americas/Montgomery Watson

09/30/2008 09:26 AM

To Michael.Rowe@deq.idaho.gov

cc barry.s.koch@monsanto.com, Robert.L.Geddes@monsanto.com, paul.b.stenhouse@monsanto.com, Cary L

bcc

Subject Fw: Rewrite of 2007 GW Report Conceptual Model Section

Mike,

Below is the rewrite of Section 3.1.4 on our updated geochemical conceptual model for Monsanto's 2007 groundwater report. Please pass this on to project agency personnel for their review.

Thanks,

Bill

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3.1.4 Conceptual Geochemical Model for Selenium Release and Groundwater Transport

The most general conceptual model for selenium release from the phosphate mining waste shales includes release from a mineral phase and transport through the waste rock dump via infiltration (Section 3.1.1). This is followed by either discharge to the surface as a seep, or infiltration and percolation to the groundwater system. There are however many geochemical processes, including those that increase and decrease the mobility of selenium, that may influence the concentrations of selenium as it migrates to a final receptor or discharge point.

When selenium-bearing waste rock is excavated and exposed to a new set of environmental conditions, there is the potential for selenium (and/or other elements) to be released from their in-situ mineral phases, become mobile and enter the aqueous environment. In order for this to occur there must be a source. All rocks contain concentrations of most of the naturally occurring elements of the periodic table. The concentrations of some of these elements may be below the level of detection with common analytical methods, while others are the principal components of the rock. For those that become environmental issues, often the inorganic element(s) of concern has been enriched above normal background. With higher concentrations in the source rock there is an increased potential that any concentrations released to the environment will also be elevated, if the environmental and chemical conditions are favorable for mobilization.

The ultimate source of selenium is the geologic material produced as waste rock from the phosphate mining operations, specifically, black shale portions of the Meade Peak Member of the Phosphoria Formation. The Meade Peak Member is elevated in selenium. In one study, the mean selenium concentration for 31 defined lithologic units in the Meade Peak formation was 77 ppm (Desborough and Poole, 1983).

Later studies by the U.S. Geological Survey (USGS) focused specifically on the Meade Peak Member of the Phosphoria Formation where it has been exposed in the phosphate mines of Southeastern Idaho (see Herring and Grauch, 2004 for a summary). The Enoch Valley Mine was included in these detailed studies (Herring et al., 1999; Grauch et al., 2001; Herring et al., 2001). Selenium data collected from the Meade Peak Member at four mines, including Enoch Valley, indicated selenium concentrations up to 1,040 ppm with an average of 71 ppm. It was found that less weathered Meade Peak sections had higher selenium concentrations (Herring and Grauch, 2004). (~~Data have been collected specifically for waste rock from a borehole at the Enoch Valley Mine. In an Enoch Valley pit backfill, the total selenium concentration was found to range from 0.79 to 139 mg/Kg (ppm) from borehole samples collected from between 5 and 343 feet below the ground surface (Tetra Tech, pending).~~ The background concentration of selenium in shale is typically reported as less than 1 ppm (Connor and Shacklette, 1975). Therefore, a source with elevated concentrations of selenium is present. These USGS data from sections in the mine areas are similar to selenium concentration data that has been collected from waste rock in the Enoch Valley mine dumps as part of studies sponsored by the Idaho Mining Association (unpublished data). The USGS also conducted studies of element leaching from the same rock descried in Herring and Grauch, 2004. Leachable selenium concentrations for two sections and one core at the Enoch Valley Mine were found to have geometric means of 0.005, 0.025 and 0.114 mg/L, respectively, with the most leachable selenium occurring in the least weathered core material (Herring, 2004). ~~It should be noted that in the same borehole investigated at the Enoch Valley Mine, it was found that the leachable selenium concentrations associated with these total selenium concentrations ranged from 0.0005 to 0.119 mg/L (using the EPA SPLP Method 1314).~~

The mineralogical form of the selenium plays a large role in the potential release to the environment. In relatively insoluble forms, the selenium may not be released into the environment as a contaminant, even if present in elevated concentrations, or released so slowly that it results in no measurable change in the environment. Some forms are readily released and others require secondary reactions for the selenium to be released. Selenium has chemical properties similar to sulfur and readily substitutes for sulfur in the lattices of sulfide minerals (Neal, 1990). Mineralogical studies by the U.S. Geological Survey (USGS) document the occurrence of seleniferous sphalerite, pyrite and organic compounds as well as native selenium in rocks of the Meade Peak Member. Selenium is also associated with organic matter (kerogen) in carbon rich rocks and with pyrite in rocks that have lower concentrations of organic carbon (Desborough et al., 1999). Selenium correlates most strongly with both organic carbon and total sulfur in the Meade Peak rocks (Herring and Grauch, 2004). Selenium bound in sulfides and organic carbon ~~Both of these forms~~ may be released as the result of oxidation reactions similar to the processes that form acid-rock drainage in metal and coal mine waste rock dumps.

It appears that the majority of the selenium in the Meade Peak waste rock is contained in sulfides and organic material that needs to be oxidized for the selenium to become mobile. However, geochemical studies of the Phosphoria Formation also indicate that a portion of the total selenium content occurs outside of these identified mineralogical reservoirs (Maxim, 2002), and studies suggest that there is a source of readily soluble selenium in relatively unweathered Meade Peak member rocks that can be released by short-term leaching (24 hour) even under anoxic conditions (Herring, 2004). ~~and that there is a source of mobile selenium in freshly unweathered Meade Peak Member rock (Tetra Tech, pending).~~ This finding suggests that selenium ~~is~~ may also be present as surficial complexes adsorbed onto clay, carbonate minerals, and oxides of iron, aluminum and manganese in the unweathered (unoxidized) rock. Iron oxyhydroxides are indicated as a reservoir for selenium in unweathered or minimal weathered Meade Peak rocks (Perkins and Foster, 2004). It is possible that this more readily soluble selenium is the result of in situ weathering of primary minerals and organic matter prior to mining.

~~Studies indicate~~It appears possible that the readily soluble forms of selenium, likely adsorbed selenite or selenate ions, are the most significant contributor to elevated aqueous selenium concentrations associated with the phosphate mining waste, and that the less soluble forms contribute ~~significantly~~ less selenium ~~(Tetra Tech, pending)~~. This in part may be due to sufficient neutralizing capacity in the waste rock, which inhibits the formation of the widespread acidic and biological conditions that enhances sulfide oxidation reactions. While the sulfide and carbon sites represent significant reservoirs for selenium, ~~R~~release from the sulfide and organic phases may be slow enough that measurable aqueous selenium may not occur. However, this may vary from site to site and may require further study to quantify. ~~However, it has been recommended this long-term release rate be characterized (Tetra Tech, pending).~~

It is the oxidizable sulfide and carbon fractions that can be most influenced by waste dump construction and reclamation activities because both oxygen and water infiltration are factors, as well as the other (carbonate) rock types that may be blended with the reactive rock and help neutralize potential acid generation. The water soluble portion is primarily affected by those measures that control water infiltration and percolation; although, local chemical environments within the waste rock dump can affect transport.

The selenium must be transported from the source to the surrounding environment once released from the mineral form. This requires both specific hydrochemical and hydrological processes. Reduced forms of selenium such as selenide (Se^{2-}) and native selenium (Se^{0}) are relatively insoluble in water, have low environmental mobility and potential for bio-availability (Seed et al.,

2000; Neal, 1990). Exposure to atmospheric oxygen, however, can oxidize selenide (Se^{2-}) from sulfides and organic matter, and native selenium (Se^{0}) into more mobile forms such as selenite (SeO_3^{2-}) and selenate (SeO_4^{2-}).

Water movement must occur to transport the selenium away from the source. Water movement from the waste rock dump material into the groundwater environment is an important factor in describing the behavior of selenium in this area. However, water movement within the source waste rock is also important in affecting the rate and volume of selenium released to the surface water and groundwater systems. It has been commonly recognized that preferential flow through the waste rock is an important process and consideration when evaluating contaminant transport (e.g., Li, 2000, Molson et al., 2005). This has a couple of effects. The first is that selenium impacted seepage may appear sooner after a waste dump is constructed than if the whole dump has to reach field capacity before seepage occurs. This prediction is consistent with observations from the mine areas. Secondly, the ultimate volume of selenium loading may be dominated by water-rock contact along the preferential flow channels. Significant portions of the dump may never become saturated enough so that gravity drainage occurs. Therefore, only a fraction of the total mass of soluble selenium in the waste rock may be available for transport. This may be especially notable for the selenium mass that is contained within the matrix of rock fragments (i.e., the preferential flow path is around the rock fragment, not through it). ~~Recent studies suggest that flow through the waste rock may be limited to relatively few preferential flow paths, limiting the amount of waste rock that may potentially act as a source (Tetra Tech, pending). This has a couple of effects. The first is that selenium impacted seepage may appear sooner after a waste dump is constructed than if the whole dump has to reach field capacity before seepage occurs. This prediction is consistent with observations from the mine areas (Tetra Tech, pending). Secondly, the ultimate volume of selenium mass that may be transported through a dump is reduced to that along the preferential flow pathways.~~

Once mobile and in transport, ~~T~~the potential exists for attenuation of selenium through the biologically mediated reduction of selenate to less mobile selenite and subsequent adsorption at any of the waste rock location settings and also along any of the three general types of groundwater flow systems. If mobile selenium forms are present, or if the top of a mine dump is oxygenated, selenium may be released and move in a mobile form. However, if the interior of the mine dump is oxygen deficient, it is possible for selenium to be reduced and become less mobile and be retained in the dump environment through adsorption or precipitation. For this to be effective, a carbon source needs to be available for the bacterial growth and development of anoxic conditions. Such anoxic conditions are indicated by some dump seepages (Herring, 2004). ~~The water soluble organic content in the waste shale has been shown to support microbial reduction of selenium (Tetra Tech, pending).~~

The sorption and oxidation/reduction processes for selenium have been studied. Selenium occurs as three principal species in oxygenated water: selenite (SeO_3^{2-}), biselenite ($HSeO_3^{-}$) and selenate (SeO_4^{2-}) (Neal, 1990; Hem, 1989). Geochemical controls that reduce or limit the solubility of selenium in water include adsorption to mineral surfaces including iron, manganese and aluminum hydroxides and oxyhydroxides (Hayes et al. 1987; Balistrieri and Chao, 1990; and Rajan, 1979). Clay and carbonate minerals may also provide effective sorption surfaces for selenium (Bar-Yosef and Meek, 1987; Cowan et al., 1990). In general, selenate is much less strongly adsorbed to mineral surfaces than is selenite. Redox potential and pH both affect selenium solubility and sorption reactions with reducing conditions and lower pH favoring sorption (Neal, 1990; McLean and Bledsoe, 1992).

Redox reaction rates involving selenium are quite rapid (Pickering et al., 1995) with the aqueous species selenite (SeO_3^{2-}) and selenate (SeO_4^{2-}) being readily reduced to insoluble Se^0 (Hem, 1989). Likewise, native selenium (Se^0) and selenide (Se^{2-}) are easily oxidized to forms that are more mobile in the environment (Pickering et al., 1995). Microbial activity is an important process that affects the redox cycling of selenium in the environment. Selenate in solution is reduced to elemental selenium and precipitated by a number of anaerobic bacteria that are present in a wide range of sediment types (Stolz et al, 2002). Sulfate reducing bacteria are common at oxic-anoxic transition zones in soils and have the capacity to enzymatically reduce selenium in a number of ways (Hockin and Gadd, 2003). Selenate may be reduced to selenide by dissimilatory sulfate-reducing pathways (Zehr and Oremland, 1987). Assimilatory reduction of selenium occurs when sulfate-reducing bacteria incorporate selenide as a trace nutrient. Sulfate reducing bacteria are also able to reduce selenium oxyanions to elemental selenium by abiotic, but biologically mediated pathways (Hockin and Gadd, 2003). The remobilization of selenium through microbially mediated oxidation also occurs. However, the rates of oxidation are generally three to four orders of magnitude less than the reductive part of the cycle (Stolz et al, 2002). The microbial mediation of selenium to volatile methylated selenium species may be a factor in the persistence of selenium in soil and water (Neal, 1990).

If the selenium is released from the dump environment into the groundwater environment many of the same attenuation processes will continue to affect the selenium mobility. So long as an anoxic environment is present and some soluble organic matter is present natural selenium attenuation may occur.

In summary, the flushing of soluble selenium can occur throughout the waste rock dump. However, this may represent a limited long-term source of selenium because this reservoir is relatively small compared to the total selenium content. The sulfide oxidation process is likely to occur on the outer shell of the dump, but can progress inward with time. This may mobilize selenium and act as a longer-term source; however, sulfide oxidation processes appear relatively inhibited in the waste shales. While, soluble selenium may be mobilized throughout the dump, other processes may work to immobilize it. ~~At depth in the dump, anoxic conditions exist in some waste dumps, and have been documented in the pit backfill at Enoch Valley (Tetra Tech, pending).~~ Pit backfills in particular are favorable for developing anoxic conditions because of more limited exterior dump surface area (a top surface) compared to exterior waste rock dumps with tops and sides. In these conditions, anaerobic bacteria many reduce the selenium to the less soluble selenite species, which may adsorb to a variety of mineral surfaces. Conversion to more reduced selenium species may result in direct precipitation. Organic matter is important for bacterial growth and the reduction process. The Phosphoria Formation, with its high organic content, may provide a carbon source and support the reduction process. ~~It is found that the Phosphoria Formation shale has organic matter that can facilitate this process (Tetra Tech, pending).~~ A key consideration for this attenuation process is whether anoxic conditions develop in the waste rock dump. This is not a given because of processes such as thermal convection through the dump and level of water saturation. The presence or absence of anaerobic bacteria can be one explanation for the variation of selenium concentration in some dump seepage.

Grauch, R.I., Tysdal, R.G., Johnson, E.A., Herring J.R., and Desborough, G.A., 2001. *Stratigraphic section and Selected Semiquantitative Chemcistry Meade Peak Phosphatic Shale Member of Permian Phosphoria Formation, Central Part of Rasmussen Ridge, Caribou County, Idaho.* United States Geological Survey Open-File Report 99-20-E, USGS, Denver, CO, 1 Plate

Herring, J. R., Desborough, G.A., Wilson, S.A., Tysdal, R.G., Grauch, R.I., and Gunter, M.E., 1999. *Chemical Composition of Weathered and Unweathered Strata of the Meade Peak Phosphatic Shale Member*

of the Permian Phosphoria Formation. United States Geological Survey Open-File Report 99-147-A, USGS, Denver, CO

Herring, J. R., Grauch, R.I., Siems, D.F., Tysdal, R.G., Johnson, E.A., Zielinski, R.A., Desborough, G.A., Knudsen, A., and Gunter, M.E., 2001. *Chemical Composition of Strata of the Meade Peak Phosphatic Shale Member of the Permian Phosphoria Formation; Channel-Composited and Individual Rock Samples of Measured Section J and Their Relationship to Measured Sections A and B, Central Part of Rasmussen Ridge, Caribou County, Idaho*, United States Geological Survey Open-File Report 01-195, USGS, Denver, CO., 68 p.

Herring, J.R., 2004. *Rock leachate geochemistry of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation, Southeast Idaho.* Handbook of Exploration and Environmental Geochemistry, Volume 8 - Life Cycle of the Phosphoria Formation: From Deposition to Post-Mining Environment, J.R. Hein editor, Elseveir B.V., Amsterdam, pp. 367 – 397.

Li, M., 2000. *Unsaturated flow and solute transport observations in large waste rock columns.* ICARD 2000, Proceedings from the Fifth International Conference on Acid Rock Drainage, Society for Mining, Metallurgy, and Exploration, Inc. (SME), Littleton, Colorado, pp. 247-256.

Molson, J.W., Fala, O., Aubertin, M., Bussiere, B., 2005. *Numerical simulations of pyrite oxidation and acid mine drainage in unsaturated waste rock piles.* Journal of Contaminant Hydrology, vol. 78, pp. 343-371.

Perkins, R.B., and Foster, A.L., 2004. *Mineral affinities and distribution of selenium and other trace elements in black shale and phosphorite of the Phosphoria Fromation.* Handbook of Exploration and Environmental Geochemistry, Volume 8 - Life Cycle of the Phosphoria Formation: From Deposition to Post-Mining Environment, J.R. Hein editor, Elseveir B.V., Amsterdam, pp. 251 – 295.

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

29 August 2008

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008

Dear Mr. Koch,

The Agencies and Tribes have reviewed the above referenced documents, submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). We have a few remaining concerns (see attached), which must be addressed.

As you are aware, the data contained within these reports are not validated. Final validation of the data may result in some changes, which will require additional review by the Agencies and Tribes.

As the *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008, are considered deliverables under the CO/AOC, per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing."

To address Agency and Tribal concerns stated in this letter, P4/Monsanto must modify Section 3.1.4 per our direction below. Rather than reprint the many pages which do not require a change, please provide us a revised Section 3.1.4 for insertion in Revision 2 by 29 September 2008. Modification as directed will result in conditional approval of these documents. Final approval will be dependent on receipt and review of the validated data.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that

incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

Please let me know if you have any questions. I can be contacted by phone at 208.236.6160 or e-mail at michael.rowe@deq.idaho.gov.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

cc: Robert Geddes (P4/Monsanto)
Bill Wright (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman, Will Frymire (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 2* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, July 2008

General Comments

2-A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document (e.g., in an appendix).

2-B. The conceptual geochemical models seem reasonable. However, like all conceptual models, they must be refined and verified as more data become available. A narrative linking and describing how well the model compares to observed conditions at the mines and identifying discrepancies is missing. The Agencies and Tribes require the 2008 Groundwater Reports to include this linkage and identification of discrepancies.

2-C. In future reports (e.g., 2008 Groundwater Reports), the cross-sections provided for the three mines should include the conceptual potentiometric surface for each aquifer system as inferred or determined from previous data and data presented in this report.

Previous Comments

1-3. Page 18, Table 2-1, Row 2 – Based on the description of MMW008 on page 11 and the drilling log and well completion diagram for MMW008 in Appendix A, it appears that the formation at screen is Dinwoody not alluvium and Dinwoody. Please revise for future reports.

New Comments

2-1. Page 42, Section 3.1.4 – There is substantial discussion regarding Conceptual Geochemical Model for Selenium Release and Groundwater Transport based primarily on a "pending" report (*Geochemical Characterization of Phosphate Mining Overburden*) by Tetra Tech dated February 2008. It is our understanding that this has not been approved by the Agencies and Tribes nor has it undergone any type of peer review. Upon further consideration, please modify Section 3.1.4 to remove discussion taken from, and referenced to, the Geochemical Characterization report. If at some point the document or parts of the document undergo peer review (e.g., for publication), we will reconsider the original report.

MWH

BUILDING A BETTER WORLD

July 11, 2008

VIA ELECTRONIC DELIVERY AND FEDERAL EXPRESS

Mr. Michael Rowe

Re: Draft Interim Report for Hydrogeologic Investigation – 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models – Revision 2

Dear Mr. Rowe:

Please find enclosed the above referenced report, including a response to comments from the Revision 1 version of the report. Revision 2 will be a complete report, including the Response to Agencies and Tribes comments, Report, Drawings, Data Tables and Appendices. Any significant language additions or changes in the report have been identified by underlining that portion of the text.

The electronic version of the report will be uploaded to the ftp site for access by everyone on the email list. Instructions for access to the ftp site will be provided via email once it has been uploaded. The hard copies/CDs should arrive at your offices on Tuesday, July 15th.

Please feel free to contact us if you have any questions or need any additional information.

Respectfully,

MWH

Cary Foulk
Supervising Hydrogeologist/Geochemist

Bill Wright
Principal Ecologist/Program Manager

cc: *Hard copy, CD and electronic version*:
Mike Rowe, Doug Tanner*,
Bruce Olenick*, Trina Judkins*, IDEQ
Gerry Winter, IDEQ
Jeff Jones, Mary Kauffman, Will Frymire*, USFS
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Response to
Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models, Revision I, April 2008*

General Comments

1-A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document (e.g., in an appendix).

Response: *The Agency/Tribal comments and associated P4 Production responses are included before the revised report.*

1-B. Please identify any significant language added to the next version of the document. All new language in a document will be highlighted except for those minor editorial changes (e.g., does not change the meaning of the sentence, paragraph, etc., or provides no additional information) identified by the Agencies and Tribes in their comments or subsequently by P4/Monsanto upon further review of the document.

Response: *Significant language changes are noted in applicable P4 Production responses and underlined in the revised document.*

Previous Comments

Comment J, Activity 3b-9. P4/Monsanto's response is insufficient. Please provide the Stiff and Piper diagrams/plots as required. P4/Monsanto may provide additional forms of data presentation should they so desire.

Response: *The requested Piper and Stiff Diagrams have been added to the report in Appendix G. At this time, the analysis is considered preliminary and is limited to the Fall 2007 data. The Piper Diagram is used to present all of the Fall 2007 data. Preliminarily, three water types were identified as the result of this presentation, and representative Stiff Diagrams were constructed illustrating the water types. Two new sections have been added to the report referencing the diagrams (Sections 2.3.6 and 3.1.5). A brief discussion of the analysis has been included. However, a more detailed presentation, analysis and discussion will be presented in the correlative 2008 report, which will address all 2007 and 2008 data.*

Comment 2. The response indicates that the text was revised although it does not appear that it was. Correct text as stated in P4/Monsanto's April 2008 response or provide an explanation of how the abandonment of MMW001 would impact MMW020 as is stated in the text.

Response: *Abandonment of MMW001 would not impact MMW020. The statement has been replaced by:*

Well MMW001 was proposed for abandonment in the MWITM (MWH 2007a); however, it was determined that the well was a dual completion with isolated screened intervals in the Phosphoria and Wells Formations. Therefore, the well was retained for monitoring groundwater elevation, and in particular, is useful for evaluating the vertical gradient between the two formations. It was not, however, retained for water quality monitoring in the Wells Formation due to uncertainty associated with its construction. MMW020 is used for water quality monitoring in this location.

Comment 10. Section J-J' is on Drawing 21, not Drawing 22 as stated.

Response: *This was an error in our comment response. The report text correctly references Drawing 21 for Section J-J'.*

Comment 18. The text was changed to:

This suggests that potential impacts to the springs from the mine waste at the Ballard Mine are a remote possibility. The potential for impacts to other groundwater receptors will be dependent upon a number of other factors including travel time and distance from the source.

Revise the first sentence, qualifying the term "remote possibility" when referring to the likelihood that the springs will not be impacted. Suggested text is as follows, "This suggests that potential impacts to the springs from the mine waste at the Ballard Mine are a remote possibility, at least in the near term."

Response: *The sentence has been revised as suggested.*

Comment 22. MMW003 was not included in Drawing 25. Please do so. Section F-F' is on Drawing 25, not Drawing 19 as stated.

Response: *MMW003 has been added as requested. A call out to the requested section has also been added to Section 3.3.1.2.*

Comment 24. The P4/Monsanto response was to add MSP014 to Section O-O' to Drawing 20. This does not address the first part of the Agency/Tribal comment:

"The topography of Drawing 10 indicates that MSP014 is probably downgradient of MMW010. MSP014 is elevated in selenium (0.07 mg/l) and is possibly a surface expression of groundwater. This discussion should be revised to include a description of this alluvial pathway including MSP014 as either a source to or an expression of local groundwater."

The discrepancy between selenium concentrations in MMW010 (<0.001 mg/l) and MSP014 (0.07 mg/l) and the flowpaths associated with the two sample locations was not addressed, as requested. Both MMW010 and MSP014 appear to hydraulically

downgradient of the southeast lobe of MWD088, and yet their selenium concentrations are clearly different. Provide an explanation of the discrepancy, if available, or discuss how the upcoming direct push or well drilling activities may resolve this discrepancy. Note also, Section O-O' is on Drawing 19, not Drawing 20 as stated.

Response: *Direct push data collected in this area will provide some information to evaluate the differences between the shallow groundwater (MMW010) and the surface water, which may be influenced by groundwater. Also, the geo-reconnaissance planned for the summer of 2008 may also be important. MSP014 is constructed partially on waste rock. Therefore, the pond may receive both direct surface water runoff and seepage from waste rock.*

The previous responses to comments incorrectly refereced Drawing 20 for Section O-O'. The report text correctly references Drawing 19 for Section O-O'.

The following text has been added to Section 3.3.1.2:

> *Pond MSP014 is also present in this area, and in the spring of 2006 had an average selenium concentration of 0.071 mg/L. It is possible that this pond receives some direct surface water runoff from waste, as well as direct waste rock seepage. The spatial relationship between MSP014 and the waste rock will be further evaluated in 2008. This area will also be included in the direct-push investigation, which may provide some insight into the migration of selenium to the pond.*

Comment 36. There were two instances where MMW091 should probably be MMW092. The first was changed but not the second (Page 73, first row). Please do so.

Response: *The correction has been made.*

Comment 37. Section J-J' is on Drawing 21, not Drawing 22 as stated.

Response: *This was an error in our comment response. The report text correctly references Drawing 21 for Section J-J'.*

Editorial Comments – It appears that several comments were not edited as indicated. (Page, paragraph, and line numbers based on *Revision 1*.)
Page 49, Section 3.2.3, Paragraph 1, Line 8 – *An* should be *In*.
Page 51, Section 3.2.4, Paragraph 2, Line 5 – It looks like *for* should be *of*.
Page 62, Section 3.4.1, Paragraph 4, Line 4 – It appears that it should be *Section K (Drawing 22)* not *Section L (Drawing 23)*.
Page 69, Table 3-3, Row 1, Column 11 – *Impact* should be *Impacts*.
Page 80, Section 5.0, Bullet 4, Line 2 – replace *the* with *Ballard* and capitalize *mine* to read *east of Ballard Mine*.
Page 80, Section 5.0, Bullet 5, Line 1 – *be* should be *being*.
Page 82, Section 6.0 – add *T.D.* to the *Brooks* reference to read *Brooks, T.D., 1982*.

Response: *The document has been edited to incorporate the editorial comments listed above.*

New Comments

1-1. Page 9, Section 2.1.1 – The section notes that "Clean water from the Enoch Valley Mine shop was added to the drilling air to suppress dust and facilitate drill cutting circulation." This is a common accepted practice and is usually necessary for efficient and safe drilling. However, the practice can "hide" the occurrence of groundwater in the saturated zone if the formations have low hydraulic conductivities. The last sentence would be more accurate if it states the supplemental water was turned off once the borehole began to "make water" which may have been caused by hitting the water table or by encountering more permeable, saturated formations. This topic also is addressed in later comments.

Response: *The sentence has been replaced by:*

> *The supplemental water was turned off once the borehole began to make water.*

1-2. Page 10, Section 2.1.3.2 – This section states "At some drilling locations groundwater was not encountered in the alluvium and as a result, drilling was continued into the Dinwoody Formation." As noted in paragraph 4 of Section 3.0, page 32, "The alluvial system may be the most important system to evaluate." Section 3.1.1.4 (last paragraph on page 39) notes the data suggest selenium is expressed "shallowly in the dump seeps and springs" at the Enoch Valley and Henry Mines and that the concentrations in the deeper alluvium and weathered bedrock are much less. Conversely, the impacts appear to be deeper in the alluvium at the Ballard Mine. Specific comments on Table 2-1, pages 18-19, address potential concerns about specific well completions. As noted in a previous comment, the presence of the water table may have been masked during air rotary drilling. Please revise as necessary.

Response: *In the report text noted above, the word "encountered" has been replaced by "observed". In addition the following sentence has been added to the end of the paragraph:*

> *It is possible that low-yielding groundwater zones were present that were not identified using the rotary drilling method. This possibility will be further evaluated in 2008 during an investigation using direct-push coring and sampling.*

1-3. Page 18, Table 2-1, Row 2 – Based on the description of MMW008 on page 11 and the drilling log and well completion diagram for MMW008 in Appendix A, it appears that the formation at screen is Dinwoody not alluvium and Dinwoody. Please revise accordingly.

Response: *Table 2-1 has been revised to indicate that in well MMW008 the formation at screen is Dinwoody.*

1-4. Pages 18-19, Table 2-1 – Monitoring well MMW007 encountered the Dinwoody Formation at a depth of 88 feet below ground surface (bgs). The depth to static water level was 40.7 feet bgs in the fall of 2007. The screen interval is 70 to 90 feet bgs and the primary filter pack is between 64 and 90 feet bgs.

Monitoring well MMW008 encountered the Dinwoody Formation at a depth of 130 feet bgs. The depth to static water level was 24.5 feet bgs in the fall of 2007. The screen interval is 177 to 197 feet bgs and the primary filter pack is between 170 to 197 feet bgs.

These examples indicate the shallower alluvium may have been saturated and the water table shallower than thought during drilling because of the condition noted in a previous comment (low permeability formations were saturated but did not produce detectable water during air rotary drilling). Please address this concern in the text.

Response: *Given the yield observed in the weathered bedrock and the clayey character of the overlaying alluvium, it is most likely that the weathered bedrock functions like a confined (semi-confined) zone. However, that does not remove the possibility that the overlaying alluvium is also saturated. Water level data collected during the direct push investigation will help characterize this system further. The following text has been added to the end of Section 3.4.1:*

> *The water yield and water levels in both MMW007 and MMW008 rose substantially once the more permeable weathered bedrock was encountered. This suggest that the water at that depth may be confined or semi-confined by the overlying clayey alluvium. Alternatively, an unconfined water table condition may be present and the depth to water may be indicative of the depth to water in the alluvium. The 2008 direct push investigation will also potentially provide data to help resolve this issue.*

1-5. Pages 18-19, Table 2-1 – Please expand this table to include the depths to formation contacts.

Response: *Depths to formation contacts has been added to Table 2-1.*

1-6. Page 23, Section 2.3.4.3 – MSP055 does not appear to be on Drawing 5? Please include.

Response: *MSP055 has been added as requested.*

1-7. Page 25, Table 2-4 – Please explain why MPW022 not sampled?

Response: *MPW022 was sampled in both Spring 2006 and Fall 2007. We assume the comment was regarding MPW023, which was not sampled in Spring 2006 because the dedicated pump was not functioning. MPW023 was sampled in Spring 2008.*

1-8. Page 49, Section 3.2.3, Paragraph 1 – The discussion of the role of faults on the hydraulics of the groundwater system is more suggestive that faults will act as barriers to groundwater flow than the discussion in Section 3.0 on page 33. An expansion of this discussion is needed to match the discussion on page 33 where faults are portrayed as potentially behaving as barriers or conduits for groundwater flow. At this time, site specific data are not available to characterize the hydraulic nature of the faults at the P4/Monsanto sites.

Response: *The discussion in Section 3.0 is generic and in this section it would not be appropriate to recognize that some faults may act as flow conduits. The discussion in Section 3.2.3 is more area specific and is based on corollary to the nearby Blackfoot Bridge project. It is likely that some (not all) faults in the Ballard Mine area are acting as flow barriers and, at a minimum, direct flow more generally in the direction of the structural grain. However, the second to last sentence of the first paragraph of Section 3.2.3 was revised as follows to highlight that some faulting in the Ballard Mine area may also act as flow conduits.*

> *This compartmentalization likely restricts flow in the Wells Formation, although it is also possible that there may be some local faulting that enhances flow in specific locations and directions.*

1-9. Page 56, Section 3.3.2, Paragraph 2 – The last sentence refers to the Phosphoria Formation as generally acting as an aquiclude. The term aquiclude is not used too often any more and the term indicates there is no flow through the Phosphoria Formation. Flow through the Phosphoria Formation is no doubt very low but it is probable that some flow does occur hence a better term to use in this context is aquitard. Please revise.

Response: *The term "aquiclude" has been replaced by "aquitard".*

1-10. Page 56, Section 3.3.2, Paragraph 4 – The paragraph describes the Henry Thrust Fault as a likely barrier to groundwater flow but springs are not apparent emerging from the Dinwoody Formation where the fault is thought to exist. Also, the low selenium concentration found in well MMW022 indicates a lack of need to investigate the hydraulic nature of this fault. The fifth paragraph states groundwater flow may occur along the strike of the bedding and folding of the Dinwoody Formation and a shallow well completed in the Dinwoody Formation "could be used to assess this potential flow path." Please clarify what actions will be taken to investigate this area.

Response: *As described in Section 3.3.5 and Table 3.4, a monitoring well will be installed in the potential Dinwoody Formation flowpath between the waste dump adjacent to MMW022 and the Little Blackfoot River (along the general strike of the formation). In addition, the stratigraphy intercepted by MMW022 appears to outcrop in the drainage*

adjacent and east of MMW022 (generally down-dip). This is a likely location for Dinwoody (intermediate flow system) springs. This area will be investigated and springs sampled if they are located.

1-11. Page 84, Section 6.0 – "Winter, 1980" is cited on page 3 but the corresponding reference has not been added to the reference section. Please add the cited reference to this list.

Response: *The citation has been added to the references section.*

1-12. Drawing 3 – Please add a label to the drawing for MMP041.

Response: *The label had been added.*

1-13. Drawings 8 and 9 – It appears these drawings should be switched and relabeled.

Response: *The correction has been made.*

1-14. Drawing 10 – Please close the northwest portion of the line delineating the location for MWD087.

Response: *The correction has been made.*

Editorial Comments

Page 6, Section 1.2.2, Paragraph 4, Line 13 – *re-established* should be *re-establish*.
Page 7, Section 1.3, Paragraph 1, Line 9 – *principals* should probably be *principles*.
Page 8, Enoch Valley Mine, Bullet 3, Line 3 – *sighting* should be *siting*.
Page 12, Section 2.2.1.2, MMW010, Line 7 – *Alluvium* should be *alluvium*.
Page 13, Section 2.2.2.2, MMW022, Line 2 – *Drawing 6* should be *Drawing 5*.
Page 15, Section 2.2.3.1, MMW021, Line 8 – *increase* should be *increased*.
Page 20, Table 2-2, Row 4, Column 7 – *700t)* should probably be *700)*.

Response: *The document has been edited to incorporate the editorial comments listed above.*

Page 20, Table 2-2, Row 11, Column 11 – *1.11/0.81* should be *1.11/0.80*.

Response: *The total selenium data for MW-15A reported in Table 2-2 is correct. The total selenium ranged from 0.81mg/L in Spring 2007 to 1.99mg/L in Fall 2007.*

Page 33, Section 3.1, Paragraph 2, Bullet 1, Line 3 – *place* should be *placed*.
Page 34, Section 3.1.1, Line 3 – *is* should be *are*.

Response: *The document has been edited to incorporate the editorial comments listed above.*

Page 39, Section 3.1.1.5, Line 2 – The terms *overlying* and *overlaying* are used in this line of the first sentence. There does not appear to be a grammatical reason for the two different terms and the suggestion is to edit this line.

Response: *The term "overlaying" was replaced by "overlying".*

Page 42, Section 3.1.4, Paragraph 6, Line 4 – *many* should be *may*.
Page 43, Section 3.1.4, Paragraph 4, Line 7 – *exists* should be *exist*.
Page 44, Section 3.2, Paragraph 2, Line 3 – *to either to the* should be *to either the*.
Page 49, Section 3.2.3, Paragraph 1, Line 3 – *principals* should probably be *principles*.
Page 49, Section 3.2.3, Paragraph 3, Line 5 – *springs* should be *Springs*.
Page 49, Section 3.2.3, Paragraph 4, Line 3 – *location* should be *located*.
Page 51, Section 3.2.4, Paragraph 1, Line 5 – it appears *installation* should be *installations*. Please edit as needed.
Page 57, Section 3.3.3, Paragraph 2, Line 4 – *this* should be *these*.
Page 70, Table 3-4, Row 8, Column 11 – *MM041* should be *MMP041*.

Response: *The document has been edited to incorporate the editorial comments listed above.*

Page 75, Section 4.2, Bullet 1 – should *2008* should be *2007*?

Response: *The phrase "new and 2008" has been deleted from the sentence to indicate that all monitoring wells, regardless of year of installation, shall be surveyed.*

Page 77, Section 4.3.3, Paragraph 2, Line 6 – eliminate *in*.
Page 77, Section 4.3.3, Paragraph 3 – eliminate the second period at the end of the paragraph.
Page 79, Section 5.0, Bullet 3, Line 6 – *were* should be *where*.
Page 80, Section 5.0, Bullet 3, Line 2 – add *at Ballard Mine* after *groundwater* to read *present in groundwater at Ballard Mine*.

Response: *The document has been edited to incorporate the editorial comments listed above.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

444 Hospital Way, #300 • Pocatello, Idaho 83201 • (208) 236-6160

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

10 June 2008

Mr. Barry Koch
Special Projects Lead - Mining
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 1* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, April 2008

Dear Mr. Koch,

The Agencies and Tribes have reviewed the above referenced documents, submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). These reports are well written and the content is a comprehensive discussion of the activities and data collected in 2007. The figures are greatly improved over older reports, which assist in the review process. P4/ Monsanto appears to have generally done a good job in responding to Agencies' and Tribes' previous comments on the *Revision 0* report. Our attached comments identify the remaining deficiencies in the deliverables.

As the *Draft Interim Report for Hydrogeologic Investigation, Revision 1* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, April 2008, are considered deliverables under the CO/AOC, per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." Therefore, the Agencies and Tribes expect revised documents incorporating our comments no later than 10 July 2008.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the

Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

We do not feel our comments require major changes in the reports and we anticipate quick approval of the documents once these comments are addressed. Please let me know if you have any questions.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

cc: Robert Geddes (P4/Monsanto)
Bill Wright (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman, Will Frymire (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agency and Tribal Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 1* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, April 2008

General Comments

1-A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document (e.g., in an appendix).

1-B. Please identify any significant language added to the next version of the document. All new language in a document will be highlighted except for those minor editorial changes (e.g., does not change the meaning of the sentence, paragraph, etc., or provides no additional information) identified by the Agencies and Tribes in their comments or subsequently by P4/Monsanto upon further review of the document.

Previous Comments

Comment J, Activity 3b-9. P4/Monsanto's response is insufficient. Please provide the Stiff and Piper diagrams/plots as required. P4/Monsanto may provide additional forms of data presentation should they so desire.

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> *This suggests that potential impacts to the springs from the mine waste at the Ballard Mine are a remote possibility. The potential for impacts to other groundwater receptors will be dependent upon a number of other factors including travel time and distance from the source.*

Revise the first sentence, qualifying the term "remote possibility" when referring to the likelihood that the springs will not be impacted. Suggested text is as follows, "This suggests that potential impacts to the springs from the mine waste at the Ballard Mine are a remote possibility, at least in the near term."

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"The topography of Drawing 10 indicates that MSP014 is probably downgradient of MMW010. MSP014 is elevated in selenium (0.07 mg/l) and is possibly a surface expression of groundwater. This discussion should be revised to include a description of this alluvial pathway including MSP014 as either a source to or an expression of local groundwater."

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New Comments

1-1. Page 9, Section 2.1.1 – The section notes that "Clean water from the Enoch Valley Mine shop was added to the drilling air to suppress dust and facilitate drill cutting circulation." This is a common accepted practice and is usually necessary for efficient and safe drilling. However, the practice can "hide" the occurrence of groundwater in the saturated zone if the formations have low hydraulic conductivities. The last sentence would be more accurate if it states the supplemental water was turned off once the borehole began to "make water" which may have been caused by hitting the water table or by encountering more permeable, saturated formations. This topic also is addressed in later comments. Please revise as necessary.

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alluvial system may be the most important system to evaluate." Section 3.1.1.4 (last paragraph on page 39) notes the data suggest selenium is expressed "shallowly in the dump seeps and springs" at the Enoch Valley and Henry Mines and that the concentrations in the deeper alluvium and weathered bedrock are much less. Conversely, the impacts appear to be deeper in the alluvium at the Ballard Mine. Specific comments on Table 2-1, pages 18-19, address potential concerns about specific well completions. As noted in a previous comment, the presence of the water table may have been masked during air rotary drilling. Please revise as necessary.

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These examples indicate the shallower alluvium may have been saturated and the water table shallower than thought during drilling because of the condition noted in a previous comment (low permeability formations were saturated but did not produce detectable water during air rotary drilling). Please address this concern in the text.

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Editorial Comments

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Page 49, Section 3.2.3, Paragraph 3, Line 5 – *springs* should be *Springs.*
Page 49, Section 3.2.3, Paragraph 4, Line 3 – *location* should be *located.*

Page 51, Section 3.2.4, Paragraph 1, Line 5 – it appears *installation* should be *installations*. Please edit as needed.
Page 57, Section 3.3.3, Paragraph 2, Line 4 – *this* should be *these*.
Page 70, Table 3-4, Row 8, Column 11 – *MM041* should be *MMP041*.
Page 75, Section 4.2, Bullet 1 – should *2008* should be *2007*?
Page 77, Section 4.3.3, Paragraph 2, Line 6 – eliminate *in*.
Page 77, Section 4.3.3, Paragraph 3 – eliminate the second period at the end of the paragraph.
Page 79, Section 5.0, Bullet 3, Line 6 – *were* should be *where*.
Page 80, Section 5.0, Bullet 3, Line 2 – add *at Ballard Mine* after *groundwater* to read *present in groundwater at Ballard Mine*.

MWH

BUILDING A BETTER WORLD

April 16, 2008

VIA ELECTRONIC DELIVERY AND FEDERAL EXPRESS

Mr. Michael Rowe

Re: Draft Interim Report for Hydrogeologic Investigation – 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models – Revision 1

Dear Mr. Rowe:

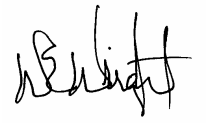
Please find enclosed the above referenced report, including a response to comments from the Revision 0 version of the report. Revision 1 incorporates changes to the report and maps; however, we are not providing another copy of the appendices at this time. The data tables and remaining appendices will be provided only in CD format and on the ftp site once data validation has been completed.

Please feel free to contact us if you have any questions or need any additional information.

Respectfully,

MWH

Cary Foulk
Supervising Hydrogeologist/Geochemist



Bill Wright
Principal Ecologist/Program Manager

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Response to
Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 0 and 2007 Hydrogeologic Data Collection Activities and Updated Conceptual Models*, February 2008

General Comments

A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document.

B. Please identify any significant language added to the next version of the document. All new language in a document will be highlighted except for those minor editorial changes (e.g., does not change the meaning of the sentence, paragraph, etc., or provides no additional information) identified by the Agencies and Tribes in their comments or subsequently by P4/Monsanto upon further review of the document.

C. Title Page – Please delete the extraneous title "P4 Production Southeast Idaho Mine-Specific Selenium Program" from the title page of this report. This report is a deliverable as required under the Administrative Order on Consent (08/20/2003), EPA Docket No. CERCLA-10-2003-0117 rather than a document generated for a P4 Selenium Program, as the title implies.

Response: *The noted text has been deleted.*

D. Please add the following language in 1.0 Introduction. These reports are being submitted as deliverables for work under the Consent Order / Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations / Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

Response: *The language has been added.*

E. Data suggest there is a vertical concentration gradient for selenium in groundwater beneath the site. Within the alluvial aquifer, springs and dump seeps tend to have high selenium compared to deeper alluvial groundwater. Underlying intermediate and deeper wells appear to exhibit decreasing selenium concentrations with depth, as well. Verification of this model will be critical to determining how much work is needed to complete the site investigation and selecting appropriate removal actions. Therefore, the positioning of new wells will be important to the confirmation of this model. Care should be taken to strategically position each new well to adequately evaluate the local vertical concentration gradient.

Response: *Acknowledged.*

F. Please include anticline and syncline axes (and plunge if known) on the geologic maps.

Response: *The two surface geologic maps, Drawings 10 and 11, have been revised to show the fold axis.*

G. Drawings 12-24

- There are several wells, springs, and other surface water features where the selenium concentrations are not shown on the corresponding sectional views, whereas, they are shown on other figures. An example is the missing selenium concentrations for MDS033 and MMW017 on section R-R', Drawing 14. All groundwater and surface water sample points on the sections should include representative selenium concentrations, as applicable.

Response: *The specific locations noted in the comment were added along with other applicable locations.*

- There are several wells, springs, and other surface water features that are close to the plan view section line but are not included on the corresponding sectional view. An example is MSG003 and its selenium concentration could be included on section Q-Q', Drawing 14. In this example, adding MSG003 to the section is important because MSG003 is contaminated (0.57 mg/l selenium) and the conceptual site model (CSM) predicts a downward gradient in the Dinwoody Formation directly beneath the spring. P4 should review all of the Drawings for similar features and add to the sections, as applicable. Other examples (not inclusive) of features that could be added to the sectional views include the following:
    - MMW018, and MSG006 on section C-C'
    - MPW023 to section E-E'
    - MSP014 to section O-O'
    - Completion depth of MPW020 on section A-A'
    - MST061 and the completion depths of MDW001, MAW003, MMW009 on section L-L'

Response: *The specific locations noted in the comment were added along with other applicable locations.*

- There are several features that are shown on sections but are not labeled. An example is section B-B', Drawing 16, where waste dump MWD087 is shown on the section but is not labeled. All pertinent features on the sections should be labeled.

Response: *The specific location noted in the comment was added along with labeling of other applicable features.*

H. The order in which the mines are discussed varies throughout this document and is not consistent with previous P4 reports. In Sections 2.2 and 3.2 and the associated tables, the order is Enoch Valley, Henry, and Ballard Mines. In Section 2.3, and the associated figures, CSMs, and data gap assessments (Section 3) the order is Ballard, Henry, and

Enoch Valley Mines. In the 2007 and 2008 groundwater work plans, the order is Enoch Valley, Henry, and Ballard Mines. Because the various documents contain a lot of information for three separate mines, the order that information is presented should be made consistent in future documents to assist the reader with their review.

Response: *The Comment is noted, and future documents will use a consistent ordering. We have not re-ordered the current document, due to the document's complexity and as this would lead to confusion relating section references in Agency/Tribes comments to a re-ordered document.*

I. The Agencies and Tribes recommend installation of a groundwater well to replace Agrium's MPW006, both for continued access and to have the well completed appropriately for the data quality objective. The A/T understand that great care will need to be taken on choosing the location of the new well that will meet data quality objectives at a reasonable depth. Evaluation of the well placement will also need to include consideration of the cone of depression relating to pumping from MPW006.

Response: *We concur with this recommendation. MWH staff will work closely with the P4 Production mine engineers to locate a geologically favorable location near the southern end of the Enoch Valley mine pit. This location will be reasonably distant from the MPW006 well and should be out of its influence. The MPW006 well is currently not in use, so even if the cone of depression extended that far the cone of depression is not currently an issue. The new well will be equipped with a water level data logger. If MPW006 is restarted, it will be possible to identify any effect. Either way, this will be useful information. If the pumping of MPW006 affects the new well, it would be to draw water from the mine area toward the new well.*

Section 4.3.3 of the report includes the following statement:

> *On the southern portion of the mine Agrium production well MPW006 should be evaluated for sampling the Wells Formation in the direction of the southerly flow vector. If not feasible, then a monitoring well should be considered.*

This statement has been replaced by:

> *A new Wells Formation monitoring well will be installed on the southern end of the backfilled Enoch Valley mine pit. This well will address a possible southeasterly flow direction in the Wells Formation along the strike of that unit. Positioning of the well will be based on geologic data obtained from the geologic model of Enoch Valley. A small amount of external waste rock may be located at the selected site, requiring an isolation casing to be advanced to the depth of bedrock. Currently the Agrium production well MPW006 is not used, and the new well will be located roughly 2,000 feet away from the production well. Therefore, MPW006 is not expected to have a hydraulic impact on the new well. However, the new monitoring well will be equipped with a water level logger, and should MPW006 go back into use, the logger data can be used to identify any effect.*

Table 3-5 for the Enoch Valley Mine has also been changed to reflect this change in approach in the "Action to Address Data Gap" column.

J. In the *Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan, Version 5* (Tech Memo) work activities were listed according to the phase of work in which they would be addressed.

- Phase I
  - Activity 3a-1.Review of Available Hydrogeologic Information
  - Activity 3a-2.Well Inventory
  - Activity 3a-3.Spring and seep survey
  - Activity 3a-4.Spring and dump seep flow characterization
  - Activity 3a-5.Sampling existing mine and domestic wells, springs, and seeps
  - Activity 3a-6.Revise conceptual hydrogeological model
- Phase II
  - Activity 3b-1.Aerial mapping of Ballard Mine
  - Activity 3b-2.Focused investigation of existing wells
  - Activity 3b-3.Existing well sampling and groundwater level monitoring
  - Activity 3b-4.Revise conceptual hydrogeologic site model
  - Activity 3b-5.Preparation of a technical memorandum for monitoring well installations
  - Activity 3b-6.Water Balance
  - Activity 3b-7.2006 groundwater sampling
  - Activity 3b-8.Review of Available Hydrogeologic Information
  - Activity 3b-9.Geochemical typing of wells, seeps, and springs
  - Activity 3b-10.Spring Flow Characterization
  - Activity 3b-11.Groundwater Level Measurements

Most of the activities identified in Phase I seem to be on-going, i.e., additional work was scheduled for Phase II. Many of the activities proposed for Phase II were accomplished in 2007. However, it did not appear that the following activities were done in 2007 – 3b-1, 3b-6, 3b-9, and 3b-10. Identify when activities 3b-1, 3b-6, and 3b-10 will be completed.

Note that 3b-9 was added based on Agency/Tribal comments (Comment 6) on the Tech Memo.

6. The assumption is made throughout the document that springs, dump seeps, and headwater streams are surface expressions of groundwater. Yet, the source for seeps could be meteoric water and the source for headwater streams could be runoff water. Mention is made of a survey that looked at 88 springs and determined the provenance of 53 of those. Nothing in the document verifies the source of water or the provenance of the springs, dump seeps, and headwater streams identified in, for example, Figures 2, 3, and 4, Table 3, or Drawings 2, 3, and 10. Please provide the provenance of springs and seeps in the mining areas. Where no provenance exists, then this is a data gap to be filled in future phases of the investigation.
   Response: An activity (Activity 3b-9) has been added to the Phase II investigation to test our hypothesis of a groundwater provenance for all springs, seeps, and headwaters denoted as surface expressions of groundwater. The testing will be done by geochemical classification using the expanded groundwater analytes (or a subset thereof).

It is unclear if sufficient cation-anion data were collected in 2007 to use along with the Piper Diagrams found in Appendix J of the Tech Memo to geochemically type the wells, seeps, springs, and headwater streams. If data are sufficient, please determine the provenance of those wells, seeps, springs, and headwater streams that can be typed. If data are not sufficient, then identify when this activity is to be completed.

Response:

The tasks identified above will be included in the Work Breakdown Structure contained in the 2008 Phase IIb Monitoring Well Technical Memorandum (April 2008).

Activity 3b-1, Aerial Mapping of Ballard Mine. This mapping was completed early in the project in 2005 and is currently being used as the post-mine base topography for the Ballard Mine. The completion of this task was reported in the Tech Memo in Section 3.2.2.

Activity 3b-6, Water Balance. This item is presented, in preliminary form, in the draft 2007 Hydrogeologic Report, which is the subject of these comments (Section 3.1). However, a substantial refinement is ongoing and will be reported on in the 2008 Hydrogeologic Report, accompanying the results from the 2008 hydrogeologic field investigation results.

Activity 3b-9, Geochemical Typing of Wells, Seeps, and Springs. Major ion data was obtained from each well, spring and seep sampling station and have been used to evaluate the ion balances as a quality control check. The data include concentrations for the cations, calcium, magnesium, sodium and potassium, and the anions, sulfate, chloride, bicarbonate and carbonate. We will be performing the geochemical typing this year, using either piper plots, stiff plots, PCA plots, or some other classification plotting. The results of this analysis will be reported in the 2008 Hydrogeologic Report.

Activity 3b-10, Spring Flow Characterization. The status of this task was reported in the Tech Memo as ongoing (Section 3.2.4). One year of data collection and recession analyses has been completed. Analyzing these data along with the Activity 3b-9 geochemical data may provide some useful insights. As such it is currently planned to report the results of these efforts together in the 2008 Hydrogeologic Report.

P4 Production believes that between the Spring Flow Characterization and the Geochemical typing data there is sufficient data to characterize the provenance of groundwater and groundwater discharge locations. However, this analysis is ongoing but will be completed and reported on in 2008. At this time, it is difficult to conceive of another data collection effort that would provide meaningful data to support this analysis.

K. Deliverables from 18, 19 June 07 meeting

- Data from ponds/wetlands in MMP036 at Ballard Mine
    - These data may be included in Table 2-6 (Page 31), but these sites are not shown on the map. Preferably, include the sites on a map (e.g., Drawing

11) or indicate where the ponds can be found in Table 2-6. If the information for the ponds/wetlands in MMP036 is not part of Table 2-6, please include them.

Response: *The pond sample locations have been illustrated on Drawing 6 and 11. Drawing 6, Well Location Map, Ballard Mine is less cluttered. A note has been added to Table 2-6 indicating that the locations are shown on Drawing 6. The pond in MMP036 is MSP062. This is now clear on Drawing 6 (and 11), and the pit identification numbers for the pit ponds has been added to Table 2-6.*

Specific Comments

1. Page 1, Section 1.1 Paragraph 3, Line 2 – Please identify the "previously unreported data from 2006…" All data to be presented in these reports should have been seen by the Agencies and Tribes at least once.

Response: *The 2006 sampling data was not included in a previously submitted, groundwater-specific document. However it was submitted to the Agencies and Tribes in the 2006 Data Validation Report. The text has been edited.*

2. Page 9, Section 2.1.2, Paragraph 2 – Provide an explanation of how the abandonment of MMW001 would impact MMW020 as is stated in the text. Note that at the March 5, 2008 meeting in Boise, MWH indicated that MMW001 was not abandoned for the reason given in the report, but that the well was retained because it might provide useful information.

Response: *It was determined that MMW001 is completed in the Phosphoria and Wells Formations. Therefore, the well will remain and be used to monitor groundwater elevation. Abandonment of MMW001 would not impact MMW020. The text has been changed.*

3. Page 14, Section 2.2.3.1, Paragraph 2 – The text states that MMW020 is south of MMW001. Drawings 6 and 11 show MMW020 to the north of MMW001. Make corrections, as necessary.

Response: *The drawings have revised.*

4. Page 14, Section 2.2.3.1, Paragraph 3 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone at MMW020-B, Ballard Mine. Water production was variable but continued past the penetration of the Wells Formation. This description suggests that discharge was continuous between the Phosphoria Formation down to the Wells Formation and that the Phosphoria Formation water bearing zone may be hydraulically interconnected to the Wells Formation aquifer. Is this new or conflicting data requiring that the CSM be modified? Was the discharge observed between 250 feet and 370 feet bgs due to leakage past the drive casing or was

there a probable interconnection between the two formations? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

Response: *It appears likely that some minor water yielding zones were encountered in the Meade Peak Member of the Phosphoria Formation at this location. It appears that the water was produced from a mudstone in the Center Waste Shale unit, with the yield increasing from 10 to 30 gpm in the water yielding strata located between 225 and 250 feet below the ground surface (ft-bgs). This is likely due to the presence of local fracturing, and not a lateraly extensive ground water unit. Flow decreased with depth to 5 gpm at 315 ft-bgs. This remaining flow was likely leakage along the casing but could have also been some flow from other minor fractured beds. The casing was advanced using an under-reamer bit and some leakage was possible. The potentiometric level in the Wells Formation is approximately 284 ft-bgs. Therefore, the water yielding strata between 225 and 250 ft-bgs appears to hydraulically isolated from the regional aquifer. In this case, the relatively small water yield is consistent with minor fractured beds in the Meade Peak, which do not represent a productive zone (in the sense of a water resource) and potential pathway. It is possible that the zone encountered would not be able to sustain a flow of 30 gpm due to its limited extent. The larger implications of these observations on the CSM are discussed in the response to Comment 7.*

5. Page 15, Section 2.2.3.2, Paragraph 1 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone between 95 feet and 110 feet bgs at MMW011-A, Henry Mine. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

Response: *The 15 gpm water yield at the MMW011-A location was likely from the Rex Chert Member. This unit and the larger implications of these observations on the CSM are discussed in the response to Comment 7.*

6. Page 16, Section 2.2.3.2, Paragraph 1 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone between 128 feet and 188 feet bgs at MMW023, Henry Mine. Also, section P-P' suggests that the water bearing zone was in the Meade Peak member which supposedly does not support groundwater. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

Response: *This drill hole was advanced in a steeply dipping section of the Phosphoria and Wells Formations (as much as 70 degrees). It is likely that a portion of the Phosphoria Formation encountered during drilling was largely the lower phosphate ore*

beds. While vertically the Wells Formation was not contacted until 350 ft-bgs, laterally the contact at the depth water was encountered was a few 10's of feet away (+/- 70 ft). Water was first encountered at approximately 128 ft-bgs. The static level in the well, representing the potentiometric condition in the Wells Formation, is approximately 106 ft-bgs. This suggests that there may be some hydraulic communication locally between the base of the Phosphoria and the Wells Formations. It is also worth noting that at this location the Grandeur Tongue Member was absent between the Phosphoria and Wells Formations, and the drill hole went almost directly from mudstones and siltstone into the water yielding Wells Formation sandstone. Here again the water yield observed in the Phosphoria Formation is likely due to local fracturing possibly caused by differential movement along the contact zone during folding. This may have resulted in some hydraulic communication from the regional aquifer up into the base of the Phosphoria Formation. However, these conditions do not represent a laterally extensive aquifer, and in this case are a local extension of the underlying regional aquifer. Groundwater flow in this portion of the stratigraphic section is still primarily in the Wells Formation. The larger implications of these observations on the CSM are discussed in the response to Comment 7.

7. Page 16, Section 2.2.3.3, Paragraph 2 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone at 150 feet bgs at MMW009, Enoch Valley Mine. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

Response: *In the case of the MMW009 location, a moderate water yield was encountered in the upper portion of the Phosphoria Formation (50 - >100 gpm). The water encountered between 150 to 185 ft-bgs is above the 209 ft-bgs static level of the Wells Formation. This information suggests that the water yielding unit is a fractured Rex Chert unit that is hydraulically isolated from the regional aquifer. The location and yield is consistent with what was observed in MPW020 to the south long the strike of the Phosphoria Formation. MPW020 produced 100 – 150 gpm from chert in the Phosphoria Formation during drilling. Sustained yield from MPW020 during two days of pumping was about 90 gpm. During the drilling of MPW020 substantial water loss from the boring was observed when the Wells Formation was encountered (i.e., the head in the Rex Chert zone was higher than in the Wells Formation). The bottom portion of the well that was open to the Wells Formation was plugged. These observations are consistent with the observations at MMW009. It should be noted that MPW020 was sampled in the spring and fall of 1998 with a total selenium result of less than 0.0007 mg/L.*

The significance of the potentially water bearing Rex Chert has been discussed on Page 2 of the 2007 Hydrogeology Report (the document addressed by these comments), but the issue was also addressed in more detail in the Monitoring Well Installation Technical Memorandum (Version 5) (MWH, 2007). Some of the relevant text is as follows:

> *…… Groundwater flow through bedrock units is controlled by several factors including the hydraulic properties of the units (i.e., horizontal and vertical hydraulic conductivities) and hydraulic gradients, the aerial extent, thickness and orientation of the geologic units, as well as structural controls such as folding, fracturing and faulting. Fracturing of bedrock rock units (especially chert and limestone) has the potential to create significant secondary hydraulic conductivity in an otherwise low-conductivity unit.*
>
> *The Phosphoria Formation does not support any major groundwater flow systems; however, Rex Chert member may transmit groundwater, where locally fractured, enough to have moderate hydraulic conductivity (Ralston et al., 1977; Ralston et al., 1980). The main ore-bearing unit in the Phosphoria formation, the Meade Peak Phosphatic Shale, is relatively impermeable due to low vertical hydraulic conductivity (McGregor, 1993; Ralston et al., 1980). Research throughout the Western Phosphate Field in Idaho has shown that the Meade Peak Member does not support significant ground water flow, particularly when flow is directed across bedding.*
>
> *A spring survey was conducted of the southeast Idaho phosphate field to gain evidence of the potential groundwater system(s) (Winter, 1980; Ralston et al., 1980). ……. A total of 88 springs were identified in the survey. The provenance of 53 springs was determined by comparing stream flows to water levels in wells. The study concluded that 42 springs flowed from the Thaynes or Dinwoody Formations at an average discharge rate of 25 gallons per minute (gpm); eight springs flowed from the Wells formation at the highest average rate of 130 gpm; and the Phosphoria Formation supported the fewest springs (three). This spring survey provides evidence of the types and extent of typical flow systems in each of the bedrock units. Many of these springs are a source of perennial flow for surface water streams in the region.*

The results of the 2007 investigation are generally consistent with these previous statements. Flow from the Phosphoria units is consistent with local secondary permeability created from fracturing focused on more competent beds (i.e., the Rex Chert). The Meade Peak Member yielded more groundwater where it overlays a productive portion of the Wells Formation at the Henry Mine, and this is still most likely localized by fracturing. There is no indication of significant flow across bedding in the Meade Peak. The Rex Chert has been found to yield amounts of water that suggest moderate hydraulic conductivity. However, regional data suggest that while this occurs the Rex Chert is not a significant bedrock aquifer when compared to the Dinwoody/Thaynes or Wells Formation aquifers.

The water yield in the Rex Chert is due to the tendency of the chert to exhibit brittle deformation behavior (more susceptible to fracturing when stressed). In certain stress fields the chert will shatter producing closely spaced open fractures. In a tectonic setting such as the one that produced the folding and faulting in the P4 Prodution mine areas, this may result in linear bands of fracturing parallel to fold axis and along thrust faults, for example. Subtle changes in the deformation stresses can result in significant changes in degree and character of fracturing and therefore permeability. So unlike the primary permeability of the sand units in the Wells Formation, the secondary permeability of the

Rex Chert will be spotty and laterally discontinuous. This is the reason that when penetrating the Rex Chert in some locations it will yield 100 gpm, but it does not display the same characteristic and as an intermediate or regional flow system like the Dinwoody/Thaynes or Wells Formation flow systems (e.g., numerous groundwater discharge points). It is likely that a moderately yielding well in the Rex Chert would exhibit declining production rates if pumped for an extended period because of the limited extent of the fractured zone. In short we feel that these concepts are in the conceptual model but may have not been communicated in the Conceptual Model Update.

The portion of Section 3.0 discussing structurally controlled flow systems will be extended to address flow in the Phosphoria Formation including the Rex Chert (second to last paragraph). The text that has been inserted reads as follows:

> *As an example of structurally developed secondary permeability, moderate groundwater yield is possible from the Rex Chert, which normally is a low permeability unit. The water yield in the Rex Chert is due to the tendency of the chert to exhibit brittle deformation behavior (more susceptible to fracturing when stressed). In certain stress fields the chert will shatter producing closely spaced open fractures. In a tectonic setting such as the one that produced the folding and faulting in the P4 Production mine areas, this may result in linear bands of fracturing parallel to fold axis and along thrust faults, for example. Subtle changes in the deformation stresses can result in significant changes in degree and character of fracturing and therefore permeability. This can also occur in other beds in the Phosphoria Formation and indeed any competent rock unit subjected to deformation. In general, these types of water bearing zones are not a target for groundwater production where other sources are present due to unpredictable results. Often high yields cannot be sustained because of the limited extent of the fractured zone. Previous studies in the Idaho phosphate area have also indicated that spring discharge to surface water from the Phosphoria Formation is an infrequent occurrence (Winter, 1980; Ralston et al., 1980). Approximately 2% of spring discharge and total stream gain was found to be supplied by the Phosphoria Formation regionally (Winter, 1980).*

And:

> *Any flow systems encountered in the Phosphoria Formation will not be regional in extent but could be intermediate or local in sporadic cases. It is most likely that where encountered in the Phosphoria Formation, groundwater occurs in isolated structurally-controlled systems confined to specific beds or units. Regardless, flow through the Phosphoria Formation perpendicular to bedding is expected to be very limited due to the presence of shales and mudstones, which are less susceptible to structurally induced secondary permeability. The potential risk and associated potential groundwater contamination is this type of system is much less than in the more laterally extensive flow systems associated with the other bedrock units. As such, the current conceptual models and hydrogeologic investigations are not focused on flow within the Phosphoria Formation. However, if significantly contaminated groundwater is encountered in the adjoining bedrock systems, then potential Phosphoria Formation flow systems*

may need to be considered and evaluated. To date conditions have not been demonstrated that would warrant an investigation of the Phosphoria Formation as a flow system pathway.

At this time, P4 Production does not feel that further characterization of the Phosphoria Formation is warranted. The more reliable water bearing zones in the Wells Formation, Dinwoody Formation and the alluvial systems should be the priority. However, this would be reconsidered in an area where these priority systems are significantly impacted and the Rex Chert could result in an additional pathway to a receptor. However, even in that instance, the remedy that would address the other units would likely by default also address the Phosphoria Formation (i.e., source control).

8. Page 19, Table 2-1 – Please add a footnote to this table that states the surveying of the measurement point elevations did not occur last fall because of weather problems. The reader is not aware of this missing piece of data until much later in the report. Most readers will probably try to calculate an elevation for the groundwater at this point and will not realize the reference elevations are missing.

Response: *A footnote has been added to inform the reader that measurement point elevations will be obtained during the 2008 field season.*

9. Page 20, Table 2-2 – Well MPW020 at the Enoch Valley Mine is stated to have casing installed to a depth below ground of 461 feet but there are perforation intervals from 401-461 feet and from 800-810 feet but the later interval is uncertain. The original total depth of the well was 810 feet. The formations monitored by the well are the Phosphoria and Wells. It is not clear how this well is completed but more detail should be included if available. If the well is open to more than on formation, the well should be retro-fitted so that only one formation is open and the apparent interconnection is stopped.

Response: *Section 2.1.3.3 states "During field activity it was discovered that MPW020 was originally drilled to 810 feet below ground surface (bgs), with casing advanced to 461 feet bgs and backfilled with cuttings and bentonite to approximately 700 feet bgs.*

The sentence "Therefore, the well does not extend into the Wells Formation" was added to Section 2.1.3.3 and Table 2-2 was edited.

10. Well MAW005 is shown to be perforated opposite the Dinwoody Formation and the Wells Formation at depths of 159-199 feet and from 199-239 feet. As presented, it appears the Phosphoria Formation is completely missing in this well. Please clarify the description of the intervals and/or depths monitored.

Response: *MAW005 was not drilled through the Phosphoria formation. Please see Section J, Drawing 22. Table 2-2 has been edited to indicate alluvium, not Dinwoody Formation.*

11. Page 23, Section 2.3.4.2 – Wells MW-15A and MW-16A should be added to the discussion on Ballard monitoring wells that exceeded the selenium MCL.

Response: *The wells were added to the discussion.*

12. Pages 25-31, Tables 2-4, 2-5, 2-6 – Add definition of "R" to table notes.

Response: *The definition of "R" (field replicate) was added to the table notes.*

13. Page 34, Section 3.1.1 – The input parameters used for the HELP modeling, for the most part, are conservative and appropriate for the generic water balance as used in this report. However, as the text indicates, a more refined estimate of net percolation through specific waste rock dumps will be forthcoming in another document. At that time, the HELP model parameters could use a closer evaluation and substantiation for values chosen, such as the saturated hydraulic conductivity of poorly graded sand being used to represent the K_{sat} for run-of-mine materials, and the inclusion of an 18" top layer of loam (growth medium) when only portions of the Enoch Valley Mine constructed after 1993 had topsoil added to the surfaces of waste rock dumps as part of reclamation.

Response: *Agreed. As we approached the problem it became apparent that the variability across the dumps is significant enough the one generic model would not be sufficient, and that the variability had to be addressed. The approach that is being implemented will couple HELP with a probabilistic analysis for each mine site. No revision to the text has been made. The results of the water balance will be presented in the 2008 Hydrogeologic Report.*

14. Page 46, Section 3.2.1.2, Paragraph 5 – The text states that MW-15A total selenium is 1.99 mg/l, whereas, Table 2-4 shows it as 1.94 mg/l. The text states that MST069 and MST067 have total selenium levels ranging from 0.029 to 0.61 mg/l, whereas, Table 2-5 shows the range as 0.022 to 1.1 mg/l. Make corrections as necessary.

Response: *The correction was made.*

15. Page 48, Section 3.2.2.2, Paragraph 2 – The data indicates that waste dump MWD093, which overlies the Dinwoody Formation in the Central Ballard Mine area, is probably a significant selenium source as represented by the high total selenium concentrations observed in springs MSG003 and MSG030-033 (0.46 mg/l – 2.2 mg/l, 2006 to 2007). The text and section H-H' indicates that surface runoff from these springs will drain into the West Pit. Does this contaminated runoff then leak into the Wells Formation at the bottom of the open pit? Could this runoff also infiltrate into the Phosphoria Formation water bearing zone that was observed at MMW020-B (see previous comment on Section 2.2.3.1, 4th paragraph of page 14)? Both potential pathways should be explained more fully in the text because they may be very significant to future removal or remedial actions at the Central Ballard Mine.

Response: *Infiltration into the Meade Peak Member of the Phosphoria Formation is not likely a significant concern as discussed in the previous comments. Nonetheless, the point is that this spring discharge could represent a secondary source that needs to be considered, and there is a potential that this could result in impacts to the Wells Formation. It therefore needs to be considered when evaluating potential remedial actions. Section 3.2.2.2 has been modified to recognize this issue by adding the following paragraph:*

> *Observations of the spring flow that discharges to the mine pit suggest that much of the flow down the dark Phosphoria Formation rocks to the mine pit evaporates along the pit walls or at the bottom of the pits. However, it is likely that selenium in this water may persist as a soluble salt, which during precipitation events is remobilized. Therefore, if the Wells Formation or other groundwater pathway is exposed in the bottom of the mine pit, this could result in an impact to groundwater flow system from a secondary source. These same conditions may exist in other Ballard pits but may be less obvious. This could in part account for the impacts in monitoring wells MMW006, MMW020, MMW021 and needs to be considered when evaluating remedial options.*

16. Page 48, Section 3.2.2.2, Paragraph 4 – The concentrations shown in the discussion for MW-15A do not match Table 2-4. Make corrections as necessary.

Response: *The correct value is 1.99 mg/l. Table 2-4 has been corrected.*

17. Page 49, Section 3.2.3, Paragraph 2 – Indicate on a map or explain as was done for Woodall Springs where Henry is.

Response: *The following text was inserted into the Section:*

> *The Henry Springs are located off the northwestern end of the Wooley Range which contains the Henry Mine. The springs are located in an area of travertine deposition that currently forms a peninsula in the Blackfoot Reservoir (Drawing 10 – springs are location just off the upper left corner of the map). The springs are located at the approximate intersection of the Henry Thrust Fault and the Slug Valley Fault, a normal fault. These structural features may have an influence on the location of the springs. The Ballard Mine area is located approximately 5.5 miles to the southeast of the spring along the structural grain and the inferred trace of the Slug Valley Fault.*

18. Page 49, Section 3.2.3, Paragraph 3 – Revise the last sentence to reflect less certainty about distant receptors of the deep regional groundwater system. Albeit a long flowpath, the risk to future receptors at distance appears to be prematurely discarded in this statement.

Response: *The last sentence of the section was changed from:*

> *Once a potential contaminant enters the regional system, a well installed near the source area is the only probable potential receptor.*

To:

> *This suggests that potential impacts to the springs from the mine waste at the Ballard Mine are a remote possibility. The potential for impacts to other groundwater receptors will be dependent upon a number of other factors including travel time and distance from the source.*

19. Page 49, Section 3.2.3.1, Paragraph 2 – The text states that there is a "general lack of potential sources located directly on outcrops of Wells Formation in higher interior areas." Although there are no waste piles above the Middle Pit of the Ballard Mine, Drawing 10 of the Version 5 of the Monitoring Well Installation Tech Memo (MWH, February 2007) shows that several unsampled ponds/wetlands are within the Middle Pit. Cross section H-H' shows the Middle Pit should be reported for selenium (or sampled if no data are available) to support the statement that further investigation of the Wells Formation in the higher interior areas of the mine appears unnecessary.

Response: *The ponds sampling locations are now shown on Drawings 6 and 11. In all likelihood there is some loose waste shale and Phosphoria Formation outcrop in the Middle Pit watershed that contribute to observed selenium concentrations in pond MSP062, 0.002 mg/L total selenium in the Spring of 2004 (the dissolved concentration was reported as 0.015 mg/L). The presence of this small seasonal pond with relatively low selenium concentrations does not seem to indicate a substantial source to the Wells Formation in the Middle Pit. Conversely, selenium concentration (≥0.05 mg/L at MSP011 and MSP012) in the ponds west of the Middle Pit in the waste rock area do suggest a source to be considered, as do the dump seeps in the area. However, in regard to the Wells Formation, monitoring wells MMW006 and MMW020 are well positioned. Between the Middle Pit and the central ridge to the east of the pit there is no waste rock deposition or other potential source material.*

20. Page 50, Section 3.2.3.2, Paragraph 1 – It appears that surveys were completed to obtain the elevations of the measuring points at wells MMW006 (older well) and newer wells MMW020 and MMW021. Please clarify with a table a summary of surveyed measuring point elevations in the report.

Response: *In Table 2-1 the column "Height of MP" has been replaced with "Elevation of MP". Only four of the Ballard wells (MMW006, 17, 20, and 21) have been surveyed; the other elevations are taken from the topographic maps.*

21. Page 50, Section 3.2.3.2, Paragraph 3, Line 7 – Revise MWD098 to MWD093 as appropriate.

Response: *The revision was made.*

22. Page, 52, Section 3.3 – It is difficult for the reader to visualize the geology and associated well completions in the area between the North and Central Henry Mine where two new wells were installed in 2007. Add a fourth cross section for the Henry Mine between North Henry and Central Henry through MMW011-A and MMW011-B, MMW019, and MMW003, approximately parallel to B-B.'

Response: *A Section F-F' was presented in the Tech Memo for this area. This section has been resurrected, updated and is included as Drawing 19.*

23. Page 53, Section 3.3.1.1, Paragraph 2 – Further reconnaissance is needed in this area yet it was not obvious in the Direct-Push Investigation (DPI) workplan that this area was included. Revise the DPI workplan as needed to include investigation of this area.

Response: *The area is included in the Direct-Push Investigation workplan.*

24. Page 54, Section 3.3.1.2, Paragraph 4 – The topography of Drawing 10 indicates that MSP014 is probably downgradient of MMW010. MSP014 is elevated in selenium (0.07 mg/l) and is possibly a surface expression of groundwater. This discussion should be revised to include a description of this alluvial pathway including MSP014 as either a source to or an expression of local groundwater. Also, include pond MSP014 in section 0-0', Drawing 19.

Response: *MSP014 has been added to Section O-O' (now Drawing 20).*

25. Page 55, Section 3.3.1.3, Paragraph 2 – Although South Henry data indicate that there are no groundwater problems, high levels of selenium at MDS022 (0.008 mg/L), MST058 (0.011 mg/L), and MST064 (0.020 mg/L) in 2006 and MST276 (0.006 mg/L) in 2007 indicate that these alluvial flowpaths are likely contributing to Se surface water problems.

Response: *The concluding statement of:*

> *These data suggest that impacts to the shallow alluvium in this area are not present.*

Has been revised to say:

> *These data suggest that impacts to the shallow alluvium in this area are not present with respect to groundwater quality standards.*

26. Page 57, Section 3.3.3, Paragraph 2 – This preliminary assessment of groundwater flow direction is appreciated. The described elevation data for the groundwater in the Wells Formation will require further discussion when the measuring points have been surveyed and new water level measurements have been made. Include these tasks in the 2008 groundwater workplan to be reported as soon as the data are surveyed and checked and in the 2008 groundwater reports.

Response: *The plan for 2008 will be modified as requested.*

27. Page 59, Section 3.3.4, Paragraph 2 – This discussion on structural controls appears to conclude that the faults perpendicular to strike at the Henry Mine are not expected to compartmentalize groundwater flow to the extent described for the Ballard Mine. However, some disruption of groundwater flow may be occurring due to the faults, thus locally altering the predicted northwesterly flow from the South and Central portions of the Henry Mine to the north. Could such faulting and potential compartmentalization alter local flowpaths such that the northernmost deep wells at MMW023 and MMW011 are outside of a representative flowpath from the southernmost portions of the mine? Confirmation that the faults identified as perpendicular to strike are not redirecting groundwater flow is very important to determining how many additional deep wells may be required to characterize deep groundwater at the Henry Mine. CSMs, geologic mapping, and groundwater monitoring results must address this potential data gap.

Response: *The following text has been added to the end of Section 3.3.4:*

> *It is recognized that faulting perpendicular to bedding may compartmentalize flow within the Wells Formation so that flow is not entirely along strike. However, a low permeability fault surface could deflect flow or simply retard it. Conceptually, the principal concern with these faults is that a well like MMW023 on the downgradient end of the mine may in fact only be seeing flow from a small area downgradient of a cross cutting fault. Water level response monitoring between MMW011 and MMW0023 on either side of the potential fault along the Little Blackfoot River will provide some information on the degree to which the fault may act as a flow barrier. A fault with a similar potential amount of potential displacement is not observed elsewhere along the strike of the Henry Mine, but should a significant flow barrier be indicated, the conceptual model would need to be revised accordingly.*

28. Page 60, Section 3.4 – The text states that groundwater wells indicate that impacts to groundwater do not extend much beyond the near-surface in the vicinity of the mine. Please reference the groundwater wells and corresponding data that were used to support this statement.

Response: *The phrase that contain the statement of:*

> *Ponds and seeps directly associated with the mine waste areas contain selenium concentrations at levels that suggest impacts to groundwater are possible (e.g., dump seep MDS026 has an average total selenium concentration of 0.12 mg/L (MWH, 2007a)); however, groundwater wells and more distal springs indicate that impacts to groundwater do not extend much beyond the near-surface in the vicinity of the mine and waste rock facilities.*

Has been modified to:

> *Ponds and seeps directly associated with the mine waste areas contain selenium concentrations at levels that suggest impacts to groundwater are possible (e.g., dump seep MDS026 has an average total selenium concentration of 0.12 mg/L (MWH, 2007a)). However, groundwater wells and more distal springs indicate that impacts to groundwater do not extend much beyond the near-surface in the vicinity of the mine and waste rock facilities as indicated by Well Formation monitoring well MMW009 and deeper alluvial system wells MMW007, MMW008 and MMW013, which were all found to have total selenium concentrations of less than or equal to 0.002 mg/L in 2007.*

29. Page 61, Section 3.4.1, Paragraph 1, Line 3 – Due to low-permeability of alluvial material at EVM "direct exposure through a water well seems less likely." Please explain what is meant here.

Response: *The following statement has been added to the end of the paragraph indicated:*

> *This is because construction of a well with sufficient groundwater yield to be of practical use from the alluvial material seems unlikely. The first potential for a usable water bearing zone appears to be in the uppermost portion of the underlying bedrock formation.*

30. Page 63, Section 3.4.3, Paragraph 4 – The text states that contact between the Wells Formation and waste rock is largely limited to backfilled pits, but according to Drawing 10, there is a not inconsequential amount of external overburden directly over Wells Formation in the southern portion of MWD092. Please either clarify text or the map.

Response: *The Wells Formation is located to the east of the mine pits as shown on Drawing 10. The area covered by MWD092 is to the west of the Wells Formation, on the southeast side of the pit, along the strike of the Phosphoria Formation. MWD092 overlies Dinwoody Formation, alluvium, and possibly some Phosphoria Formation, but not Wells Formation. To provide some additional clarification to this the following sentence has been added to the end of the paragraph indicated:*

The waste dumps have lapped over onto the Dinwoody Formation in areas west of the mine pits.

31. Page 67, Table 3-3, Row 2, Column 6 – The selenium value for MW-15A is not consistent with Table 2-2 or 2-4. Also, it may be misleading to only show the analytical results from Fall 2007 for MW-15A and MW-16A. For example, Table 3-3 shows the representative concentration is 0.049 mg/l (Fall 2007) for MW-16, whereas, the spring 2007 selenium concentration was substantially higher at 0.11 mg/l. Revise tables and figures as appropriate to depict range of concentrations observed.

Response: *Data for wells MW-15A and MW-16A has been revised in Tables 2-2, 2-4, and 3-3. Data tables for all other wells will be revised once the data are validated. All validated data will be submitted to the Agencies and Tribes.*

32. Page 68, Table 3-3

- List the Ballard Mine waste dump and open mine pit ID numbers in the "Location/Potential Sources" column for the Regional-Wells Formation.
- In the Ballard Mine Regional-Wells Formation, Eastern Mine Area, Completed Flowpath column, the pathway is shown as not complete. Cross sections T-T' and S-S' indicate that contaminated alluvial groundwater traveling east could potentially flow past the Slug Valley fault and leak into the Wells Formation, thus indicating this is potentially a complete pathway. Revise table accordingly or provide additional information supporting a "not complete" pathway designation.

Response: *Waste dump and open pit ID numbers have been added as requested. The concept of impacted alluvial flow infiltrating to the Wells Formation has been added to the Data Gap column and the Completed Pathway column has been changed to "Possible". The revised Action to Address the Data Gap is indicated as the direct-push program that will map the extent of the alluvial impact (this is already planned and is not new work). The Comment column already indicated that the Wells Formation might need to be tested if highly impacted water was found east of the Slug Valley Fault.*

33. Page 70, Table 3-4 – For the Henry Mine Intermediate-Dinwoody/Thaynes Formation Conceptual Flowpath, add MWD085 as a potential source because a lobe of the waste dump extends onto the Dinwoody Formation according to Drawing 10. In the same row, show the representative selenium concentration for MMW022 in the Monitoring Wells in Flowpath column.

Response: *MWD085 was shown in the source column: "NE side of Henry Mine (MWD086)". The parentheses have been removed and MWD086 now stands alone. The concentration for MMW022 has been added as requested.*

34. Page 72, Table 3-5 – Similar to what was done for the Local-Alluvial Conceptual Flowpath identify the area of the mine (e.g., South, North, Central) for all the Intermediate-Dinwoody/Thaynes Formation Location/Potential Sources. List applicable

waste dump and open mine pit ID numbers in the "Location/Potential Sources" column (i.e., MWD091).

Response: *The requested additions have been included.*

35. Page 73, Table 3-5 – List applicable open and backfilled mine pit ID numbers in the Intermediate-Dinwoody/Thaynes Formations, Location/Potential Sources column of the table.

Response: *The requested additions have been included.*

36. Page 73, Table 3.5 – For the Enoch Valley Mine Intermediate-Dinwoody/Thaynes Formation Conceptual Flowpath, please verify the identification of the "Data Gap" referred to as "MWD091." The appropriate data gap may be MWD092.

Response: *The correction has been made.*

37. Page 77, Section 4.3.3, Paragraph 3 – text indicates that MPW006 will be evaluated for sampling in the Wells Formation. Table 2-2 indicates this well was completed in the Dinwoody/Thaynes Formation. In the 5 March 2008 meeting of P4/Monsanto with the Agencies and Tribes in Boise, MWH indicated MPW006 actually extends into the Wells Formation. Correct the table, as appropriate.

Response: *Table 2-2 has been edited to indicate the well is screened in Phosphoria and Wells Formation. This is consistent with Section J, Drawing 22.*

38. Page 78, Section 5.0, Bullet 3 – Please provide references to specific data presented to date to support the statement that groundwater springs discharging from the shallowest portion of the alluvial system, when contaminated, display generally higher levels of selenium than do deeper contaminated portions of the alluvial system.

Response: *The following text has been added to the referenced bullet:*

> *This can be observed in several areas like on the east side of the Ballard Mine were MMW018 (0.029 mg/L total Se) in the deeper alluvium has lower selenium concentrations than springs located in the same area and further downgradient from the source (e.g., MSG006, up to 0.15 mg/L). It is also notable at Enoch Valley where dump seep MDS026 (0.068 - 0.019 mg/L total Se) is located adjacent to alluvial monitoring well MMW007 (0.002 mg/L total Se).*

39. Page 80, Table 5-1, Henry Mine – A deep Wells Formation well closer to the South-Central potion of the Henry may be recommended due to the length of the mine, and potential for "compartmentalization" due to faulting, depending on the findings of the Phase IIb groundwater investigation scheduled for 2008. The agencies generally agree with the CSM that hypothesizes that flow is mostly along the bedding strike of the Wells

Formation. However, faulting perpendicular to strike and other structural features may cause groundwater to be diverted away from the northern downgradient wells at MMW011 and MMW023.

Response: *Comment noted, and this has been added as a data gap on Table 3-4 for the Henry Mine. Evaluation of the water levels in the Wells Formation wells on the north end of the mine, which spans a probable fault, and other analyses, such as water typing, will help determine the need for the additional monitoring well. In particular, water level data loggers in MMW011 and MMW023 will help assess the hydraulic connection across the fault.*

40. Page 80, Table 5-1 – There were several tasks identified in the narrative that were not included in the table (5-1) of work to be done in 2008. These tasks include the following, which must be incorporated as work tasks for 2008 in Table 5-1 or another appropriate table.

- All three Mines – test alluvial material for predominance of silt and clay and hydraulic conductivity (mentioned pages 38, 39, 61)
    - Geologic reconnaissance of basalt area near Little Blackfoot River (mentioned page 54)
    - Seep/spring survey northeast of MMW022 (mentioned page 56)
    - Validate water levels in MMW011 and MMW023 (mentioned pate 57)
    - Water balance for waste dumps and Wells Formation (mentioned page 70)
- Enoch Valley Mine – evaluation of flexure area (mentioned pages 65, 73)

Response: *The tasks identified above are included in the Work Breakdown Structure contained in the 2008 Phase IIb Monitoring Well Technical Memorandum (April 2008).*

41. Drawing 10 – The ponds (e.g., MSP017 and MSP020) need to be filled in with blue color.

Response: *The correction has been made.*

42. Drawing 11 – Please identify the location of MWD082 on this drawing; the stipple overlay appears to be missing. MSP062, noted on page 67, is not apparent on this drawing. Please add if missing from the drawing. Also note that MW-15A and MW-16A are labeled as MMW15A and MMW16A. Make corrections as necessary.

Response: *The corrections and additions have been made.*

43. Drawing 11 and Section H-H' – Section H-H' is a very important conceptual view of the west Ballard area. To capture even more information, this section should be moved slightly north to include MW-015A, MST068, and the adjoining westernmost lobe of MWD081.

Response: *Section H-H' was modified by bending and moving the west end of the section so that it runs through MW-15A and MST068.*

44. Appendix A – The well log for MMW009 is missing the lithology below 100 feet bgs. It is understood that circulation was lost below 360 feet bgs. Please include available lithology for the 100 feet to 360 feet bgs.

Response: *Additional description of drill cuttings will be added to the log between 90 to 530 feet.*

45. Appendix A – Some well completion figures show an elevation in the right hand column, but the nature of the measuring point is not noted. Please add a description to the figures for MMW006, MMW017B, and MMW020B that identifies whether the elevation is a ground surface elevation or a measuring point elevation for the depth to groundwater measurements.

Response: *The elevations given are of the measuring point. The figures will be revised.*

46. Appendix B, C &D – These appendices are missing water quality data for MW-15A and MW-16A. Add relevant information.

Response: *Total selenium results for wells MW-15A and MW-16A are given in Table 2-4. A complete data set of all analyses for these two wells is being obtained. Those data, in addition to a complete set of validated data for all wells, will be submitted on compact disk to the Agencies and Tribes.*

47. Appendix C, Table 2, Pages 2, 4 – The following wells have greater concentrations (greater than or equal to 500 mg/L) of total dissolved solids than the other wells at the Enoch Valley, Henry, or Ballard mines: MMW001, MMW013, MMW014, MMW017, MMW019, MMW020, and MMW022. Please discuss possible causes of the greater total dissolved concentrations in these wells.

Response: *At this time it is premature to provide a detailed discussion of this water typing issue in the report until a complete evaluation is finished. This will be reviewed in much more detail and presented in the 2008 Hydrogeologic Report. However, some preliminary thoughts are as follows:*

Conceptually, in this hydrogeologic setting groundwater with elevated TDS originates from either older bedrock groundwater or waste rock dump seepage. The first is characterized as a bicarbonate water type and the later, a sulfate water type.

MMW001 and MMW020 – Much of the TDS in these sample results are from calcium and bicarbonate (430 – 470 mg/L range), which is characteristic of regional groundwater in the Wells Formation. MMW020 is a replacement well for MMW001.

MMW013 – This well contains elevated sulfate (sulfate > bicarbonate) but no detectable selenium. This may be an indication of dump seepage where selenium has been attenuated. This type of water will be an important focus of the water typing analysis.

MMW014 – This well has a strong calcium bicarbonate signature with very little sulfate suggesting a significant bedrock groundwater component. This may indicate an area of bedrock groundwater upwelling. Springs and some dump seeps display similar character in this area. Once again, the water typing analysis may enhance the understanding of the hydrogeology in this area. This observation if valid may further support the concept of regional Wells Formation groundwater flow to the northwest in the Henry Mine area.

MMW017 – This Ballard Mine monitoring well has elevated sulfate as well as selenium. This suggests that the elevated TDS is due to waste rock impacted groundwater.

MMW019 – Both MMW019 and the nearby MMW011 are of a mixed water type with magnesium, calcium, sodium, chloride, sulfate, and bicarbonate. Calcium bicarbonate dominates but the contributions of the other ions, especially the sodium chloride, will need to be considered during the water typing analysis. The older MMW003 and MMW004 wells also exhibit this signature. It may be uniquely related to the basalt that is present at this location.

MMW022 – This well has a mixed calcium sulfate and bicarbonate as well as some selenium. This suggests that there is a component of dump seepage that is contributing to the TDS.

Editorial Comments

Page 51, Section 3.2.3.3, Paragraph 2, Line 4 – Based on Table 2-4, the concentration at MW-15A was *1.94 mg/l* not *1.99mg/l*.

Response: *The correct value is 1.99 mg/l. Table 2-4 has been corrected.*

Page 58, Table 3-2 – which column is south of the Little Blackfoot River?

Response: *The right-hand column is "South of the Little Blackfoot River".*

Page 63, Section 3.4.3, Paragraph 2, Line 7 – *Henry* should probably be *Enoch Valley.*

Response: *The edit was not made. The intent was to explain that if the thrust fault is not a barrier, the recharge in the Henry Mine area will likely nonetheless result in groundwater flow deflecting to the northwest.*

Page 1, Section 1.1, Paragraph 3, Line 2 – capitalize *tribes* to read *Tribes*
Page 11, Section 2.2, Paragraph 2, Line 2 – insert a comma after *e.g.* to read *(e.g., slug.*
Page 12, Section 2.2.1.2, Paragraph 1, Line 2 – insert an *n* to read *northwestern side.*
Page 15, Section 2.2.3.1, Paragraph 2, Line 3 – insert a comma after *14* to read *10, 11, and 14, 2007.*

Page 23, Section 2.3.4.2, Paragraph 2, Line 6 – *screen* should be *screened.*
Page 39, Section 3.1.1.5, Paragraph 1, Line 5 – *baring* should be *barring.*
Page 40, Section 3.1.3, Paragraph 1, Line 6 – *expose* should be *exposed.*
Page 43, Section 3.1.4, Paragraph 5, Line 12 – *Conversation* should be *Conversion.*
Page 45, Section 3.2.1.1, Paragraph 1, Line 1 – Section S is on Drawing 15.
Page 46, Section 3.2.1.2, Paragraph 2, Line 4 – *in* should be *is.*
Page 48, Section 3.2.3, Paragraph 1, Line 11 – *affects* should be *effects.*
Page 48, Section 3.2.3, Paragraph 1, Line 11 – *An* should be *In.*
Page 49, Section 3.2.3, Paragraph 1, Line 1 – *affects* should be *effects.*
Page 49, Section 3.2.3, Paragraph 2, Line 9 – *Woodall Spring* should be *Woodall Springs.*
Page 48, Section 3.2.3.1, Paragraph 2, Line 1 – *extend* should be *extends.*
Page 50, Section 3.2.3.2, Paragraph 1, Line 15 – insert *the* before *memorandum* to read *discussed in the memorandum.*
Page 51, Section 3.2.4, Paragraph 2, Line 4 – *Sighting* should be *Siting.*
Page 51, Section 3.2.4, Paragraph 2, Line 5 – It looks like *for* should be *of.*
Page 51, Section 3.2.4, Paragraph 3, Line 7 – *MMW0017* should be *MMW017.*
Page 55, Section 3..3.1.3, Paragraph 2, Line 9 – Based on Table 2-5, the concentration at MDS022 was *0.008 mg/l* not *0.006 mg/l.*
Page 57, Section 3.3.3, Paragraph 2, Line 6 – *if* should be *of.*
Page 62, Section 3.4.1, Paragraph 2, Line 4 – It appears that it should be *Section K (Drawing 22)* not *Section L (Drawing 23).*
Page 62, Section 3.4.2, Paragraph 1, Line 5 – insert *be* between *to* and *a* to read *observed to be a.*
Page 63, Section 3.4.3, Paragraph 2, Line 5 – *barriers* should probably be *barrier.*
Page 65, Section 3.4.5, Paragraph 3, Line 7 – *verses* should be *versus.*
Page 67, Table 3-3, Row 2, Column 6 – *MM-15A* should be *MW-15A.*
Page 68, Table 3-3, Row 7, Column 11 – *Impact* should be *Impacts.*
Page 70, Table 3-4, Row 9, Column 11 – *seem* should be *seems.*
Page 73, Table 3-5, Row 4, Column 11 – *at* should be *are.*
Page 73, Table 3-5, Row 5, Column 11 – *technical* should be *technically.*
Page 75, Section 4.2, Paragraph 1, Line 4 – *he* should be *be.*
Page 79, Section 5.0, Bullet 2 – add a period to the end of the bullet.
Page 79, Section 5.0, Bullet 3, Line 2 – replace *the* with *Ballard* and capitalize *mine* to read *east of Ballard Mine.*
Page 79, Section 5.0, Bullet 4, Line 1 – *be* should be *being.*
Page 81, Section 6.0 – add *T.D.* to the *Brooks* reference to read *Brooks, T.D., 1982.*

Response: *The document has been edited to incorporate the editorial comments listed above.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

14 March 2008

Mr. Robert Geddes
P4 Production, LLC
PO Box 816
Soda Springs, ID 83276-0816

Re: *Draft Interim Report for Hydrogeologic Investigation, Revision 0* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models* February 2008

Dear Mr. Geddes,

The Agencies and Tribes have reviewed the above referenced document, submitted by P4/Monsanto pursuant to Consent Order/Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0117 (CO/AOC). The readability of these reports is much improved compared to previous deliverables. The number and quality of cross-sections greatly facilitated understanding of the placement of groundwater wells and relative flow paths. Our attached comments identify the remaining deficiencies in the deliverables. Included are several of the comments we discussed at our 5 March meeting.

As the *Draft Interim Report for Hydrogeologic Investigation, Revision 0* and *2007 Hydrogeologic Data Collection Activities and Update Conceptual Models* are considered deliverables under the CO/AOC, per Section 9.7 of the CO/AOC, "Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing." Therefore, the Agencies and Tribes expect revised reports incorporating our comments no later than 16 April 2008.

The CO/AOC clearly states that all deliverables shall be submitted in draft form, and are subject to review, comment, and written approval or disapproval by IDEQ. For each draft document, P4/Monsanto shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies. Should P4/Monsanto decide not to comply with the comments provided by IDEQ on behalf of all the Agencies and Tribes, discussions to resolve those issues should be initiated. However, after the Agencies and Tribes have reviewed P4/Monsanto's position and issued instructions to P4/Monsanto to incorporate the original comments, P4/Monsanto must comply or initiate

dispute resolution. Future deliverables will be deemed deficient and disapproved should P4/Monsanto fail to comply with the CO/AOC regarding incorporation of Agency/Tribal comments and stipulated penalties may be initiated from the date the revised deliverable was due.

The Agencies and Tribes look forward to working with you to finalize these documents as quickly as possible. Please let me know if you have any questions on the above.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

cc: Bill Wright (MWH)
Doug Tanner, Bruce Olenick (IDEQ)
Jeff Jones, Mary Kauffman (C-TNF)
Jason Sturm (BLM)
Allen Ruberry (IDL)
Kelly Wright (Shoshone-Bannock Tribes)
Sandi Arena (USFWS)
Dave Tomten (EPA)
Bill Wiley (BIA)
File copy/Monsanto/Correspondence

Agencies and Tribes Comments on *Draft Interim Report for Hydrogeologic Investigation, Revision 0 and 2007 Hydrogeologic Data Collection Activities and Update Conceptual Models*, February 2008

General Comments

A. Please include all Agency/Tribal comments and P4/Monsanto responses to resolve those comments in the next version of the document.

B. Please identify any significant language added to the next version of the document. All new language in a document will be highlighted except for those minor editorial changes (e.g., does not change the meaning of the sentence, paragraph, etc., or provides no additional information) identified by the Agencies and Tribes in their comments or subsequently by P4/Monsanto upon further review of the document.

C. Title Page - Please delete the extraneous title "P4 Production Southeast Idaho Mine-Specific Selenium Program" from the title page of this report. This report is a deliverable as required under the Administrative Order on Consent (08/20/2003), EPA Docket No. CERCLA-10-2003-0117 rather than a document generated for a P4 Selenium Program, as the title implies.

D. Please add the following language in 1.0 Introduction. These reports are being submitted as deliverables for work under the Consent Order/Administrative Order on Consent for the Performance of Site Investigations and Engineering Evaluations/Cost Analysis (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho (08/20/03), EPA Docket No. CERCLA-10-2003-0117.

E. Data suggest there is a vertical concentration gradient for selenium in groundwater beneath the site. Within the alluvial aquifer, springs and dump seeps tend to have high selenium compared to deeper alluvial groundwater. Underlying intermediate and deeper wells appear to exhibit decreasing selenium concentrations with depth, as well. Verification of this model will be critical to determining how much work is needed to complete the site investigation and selecting appropriate removal actions. Therefore, the positioning of new wells will be important to the confirmation of this model. Care should be taken to strategically position each new well to adequately evaluate the local vertical concentration gradient.

F. Please include anticline and syncline axes (and plunge if known) on the geologic maps.

G. Drawings 12-24

- There are several wells, springs, and other surface water features where the selenium concentrations are not shown on the corresponding sectional views, whereas, they are shown on other figures. An example is the missing selenium concentrations for MDS033 and MMW017 on section R-R', Drawing 14. All groundwater and surface water sample points on the sections should include representative selenium concentrations, as applicable.

- There are several wells, springs, and other surface water features that are close to the plan view section line but are not included on the corresponding sectional view. An example is MSG003 and its selenium concentration could be included on section Q-Q', Drawing 14. In this example, adding MSG003 to the section is important because MSG003 is contaminated (0.57 mg/l selenium) and the conceptual site model (CSM) predicts a downward gradient in the Dinwoody Formation directly beneath the spring. P4 should review all of the Drawings for similar features and add to the sections, as applicable. Other examples (not inclusive) of features that could be added to the sectional views include the following:
    - MMW018, and MSG006 on section C-C'
    - MPW023 to section E-E'
    - MSP014 to section O-O'
    - Completion depth of MPW020 on section A-A'
    - MST061 and the completion depths of MDW001, MAW003, MMW009 on section L-L'
- There are several features that are shown on sections but are not labeled. An example is section B-B', Drawing 16, where waste dump MWD087 is shown on the section but is not labeled. All pertinent features on the sections should be labeled.

H. The order in which the mines are discussed varies throughout this document and is not consistent with previous P4 reports. In Sections 2.2 and 3.2 and the associated tables, the order is Enoch Valley, Henry, and Ballard Mines. In Section 2.3, and the associated figures, CSMs, and data gap assessments (Section 3) the order is Ballard, Henry, and Enoch Valley Mines. In the 2007 and 2008 groundwater work plans, the order is Enoch Valley, Henry, and Ballard Mines. Because the various documents contain a lot of information for three separate mines, the order that information is presented should be made consistent in future documents to assist the reader with their review.

I. The Agencies and Tribes recommend installation of a groundwater well to replace Agrium's MPW006, both for continued access and to have the well completed appropriately for the data quality objective. The A/T understand that great care will need to be taken on choosing the location of the new well that will meet data quality objectives at a reasonable depth. Evaluation of the well placement will also need to include consideration of the cone of depression relating to pumping from MPW006.

J. In the *Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan, Version 5* (Tech Memo) work activities were listed according to the phase of work in which they would be addressed.

- Phase I
    - Activity 3a-1.Review of Available Hydrogeologic Information
    - Activity 3a-2.Well Inventory
    - Activity 3a-3.Spring and seep survey
    - Activity 3a-4.Spring and dump seep flow characterization
    - Activity 3a-5.Sampling existing mine and domestic wells, springs, and seeps

- Activity 3a-6.Revise conceptual hydrogeological model

- Phase II
  - Activity 3b-1.Aerial mapping of Ballard Mine
  - Activity 3b-2.Focused investigation of existing wells
  - Activity 3b-3.Existing well sampling and groundwater level monitoring
  - Activity 3b-4.Revise conceptual hydrogeologic site model
  - Activity 3b-5.Preparation of a technical memorandum for monitoring well installations
  - Activity 3b-6.Water Balance
  - Activity 3b-7.2006 groundwater sampling
  - Activity 3b-8.Review of Available Hydrogeologic Information
  - Activity 3b-9.Geochemical typing of wells, seeps, and springs
  - Activity 3b-10.Spring Flow Characterization
  - Activity 3b-11.Groundwater Level Measurements

Most of the activities identified in Phase I seem to be on-going, i.e., additional work was scheduled for Phase II. Many of the activities proposed for Phase II were accomplished in 2007. However, it did not appear that the following activities were done in 2007 – 3b-1, 3b-6, 3b-9, and 3b-10. Identify when activities 3b-1, 3b-6, and 3b-10 will be completed.

Note that 3b-9 was added based on Agency/Tribal comments (Comment 6) on the Tech Memo.

6. The assumption is made throughout the document that springs, dump seeps, and headwater streams are surface expressions of groundwater. Yet, the source for seeps could be meteoric water and the source for headwater streams could be runoff water. Mention is made of a survey that looked at 88 springs and determined the provenance of 53 of those. Nothing in the document verifies the source of water or the provenance of the springs, dump seeps, and headwater streams identified in, for example, Figures 2, 3, and 4, Table 3, or Drawings 2, 3, and 10. Please provide the provenance of springs and seeps in the mining areas. Where no provenance exists, then this is a data gap to be filled in future phases of the investigation.
   Response: An activity (Activity 3b-9) has been added to the Phase II investigation to test our hypothesis of a groundwater provenance for all springs, seeps, and headwaters denoted as surface expressions of groundwater. The testing will be done by geochemical classification using the expanded groundwater analytes (or a subset thereof).

It is unclear if sufficient cation-anion data were collected in 2007 to use along with the Piper Diagrams found in Appendix J of the Tech Memo to geochemically type the wells, seeps, springs, and headwater streams. If data are sufficient, please determine the provenance of those wells, seeps, springs, and headwater streams that can be typed. If data are not sufficient, then identify when this activity is to be completed.

K. Deliverables from 18, 19 June 07 meeting

- Data from ponds/wetlands in MMP036 at Ballard Mine
  - These data may be included in Table 2-6 (Page 31), but these sites are not shown on the map. Preferably, include the sites on a map (e.g., Drawing 11) or indicate where the ponds can be found in Table 2-6. If the information for the ponds/wetlands in MMP036 is not part of Table 2-6, please include them.

Specific Comments

1. Page 1, Section 1.1, Paragraph 3, Line 2 – Please identify the "previously unreported data from 2006 . . ." All data to be presented in these reports should have been seen by the Agencies and Tribes at least once.

2. Page 9, Section 2.1.2, Paragraph 2 – Provide an explanation of how the abandonment of MMW001 would impact MMW020 as is stated in the text. Note that at the March 5, 2008 meeting in Boise, MWH indicated that MMW001 was not abandoned for the reason given in the report, but that the well was retained because it might provide useful information.

3. Page 14, Section 2.2.3.1, Paragraph 2 – The text states that MMW020 is south of MMW001. Drawings 6 and 11 show MMW020 to the north of MMW001. Make corrections, as necessary.

4. Page 14, Section 2.2.3.1, Paragraph 3 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone at MMW020-B, Ballard Mine. Water production was variable but continued past the penetration of the Wells Formation. This description suggests that discharge was continuous between the Phosphoria Formation down to the Wells Formation and that the Phosphoria Formation water bearing zone may be hydraulically interconnected to the Wells Formation aquifer. Is this new or conflicting data requiring that the CSM be modified? Was the discharge observed between 250 feet and 370 feet bgs due to leakage past the drive casing or was there a probable interconnection between the two formations? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

5. Page 15, Section 2.2.3.2, Paragraph 1 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone between 95 feet and 110 feet bgs at MMW011-A, Henry Mine. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

6. Page 16, Section 2.2.3.2, Paragraph 1 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone between 128 feet and 188 feet bgs at MMW023, Henry Mine. Also, section P-P' suggests that the water bearing zone was in the Meade Peak member which supposedly does not support groundwater. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be

further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

7. Page 16, Section 2.2.3.3, Paragraph 2 – The text indicates that the Phosphoria Formation contained a relatively productive water bearing zone at 150 feet bgs at MMW009, Enoch Valley Mine. Is this new or conflicting data requiring that the CSM and groundwater monitoring plan be modified? Is this productive zone in the Phosphoria a potential pathway that should be further evaluated? Revise the report, including the CSM, text, and figures as appropriate to address these questions and the broader implications of this observation.

8. Page 19, Table 2-1 – Please add a footnote to this table that states the surveying of the measurement point elevations did not occur last fall because of weather problems. The reader is not aware of this missing piece of data until much later in the report. Most readers will probably try to calculate an elevation for the groundwater at this point and will not realize the reference elevations are missing.

9. Page 20, Table 2-2 – Well MPW020 at the Enoch Valley Mine is stated to have casing installed to a depth below ground of 461 feet but there are perforation intervals from 401-461 feet and from 800-810 feet but the later interval is uncertain. The original total depth of the well was 810 feet. The formations monitored by the well are the Phosphoria and Wells. It is not clear how this well is completed but more detail should be included if available. If the well is open to more than one formation, the well should be retro-fitted so that only one formation is open and the apparent interconnection is stopped.

10. Well MAW005 is shown to be perforated opposite the Dinwoody Formation and the Wells Formation at depths of 159-199 feet and from 199-239 feet. As presented, it appears the Phosphoria Formation is completely missing in this well. Please clarify the description of the intervals and/or depths monitored.

11. Page 23, Section 2.3.4.2 – Wells MW-15A and MW-16A should be added to the discussion on Ballard monitoring wells that exceeded the selenium MCL.

12. Pages 25-31, Tables 2-4, 2-5, 2-6 – Add definition of "R" to table notes.

13. Page 34, Section 3.1.1 – The input parameters used for the HELP modeling, for the most part, are conservative and appropriate for the generic water balance as used in this report. However, as the text indicates, a more refined estimate of net percolation through specific waste rock dumps will be forthcoming in another document. At that time, the HELP model parameters could use a closer evaluation and substantiation for values chosen, such as the saturated hydraulic conductivity of poorly graded sand being used to represent the K_{sat} for run-of-mine materials, and the inclusion of an 18" top layer of loam (growth medium) when only portions of the Enoch Valley Mine constructed after 1993 had topsoil added to the surfaces of waste rock dumps as part of reclamation.

14. Page 46, Section 3.2.1.2, Paragraph 5 – The text states that MW-15A total selenium is 1.99 mg/l, whereas, Table 2-4 shows it as 1.94 mg/l. The text states that MST069 and MST067 have total selenium levels ranging from 0.029 to 0.61 mg/l, whereas, Table 2-5 shows the range as 0.022 to 1.1 mg/l. Make corrections as necessary.

15. Page 48, Section 3.2.2.2, Paragraph 2 – The data indicates that waste dump MWD093, which overlies the Dinwoody Formation in the Central Ballard Mine area, is probably a significant selenium source as represented by the high total selenium concentrations observed in springs MSG003 and MSG030-033 (0.46 mg/l – 2.2 mg/l, 2006 to 2007). The text and section H-H' indicates that surface runoff from these springs will drain into the West Pit. Does this contaminated runoff then leak into the Wells Formation at the bottom of the open pit? Could this runoff also infiltrate into the Phosphoria Formation water bearing zone that was observed at MMW020-B (see previous comment on Section 2.2.3.1, 4th paragraph of page 14)? Both potential pathways should be explained more fully in the text because they may be very significant to future removal or remedial actions at the Central Ballard Mine.

16. Page 48, Section 3.2.2.2, Paragraph 4 – The concentrations shown in the discussion for MW-15A do not match Table 2-4. Make corrections as necessary.

17. Page 49, Section 3.2.3, Paragraph 2 – Indicate on a map or explain as was done for Woodall Springs where Henry is.

18. Page 49, Section 3.2.3, Paragraph 3 – Revise the last sentence to reflect less certainty about distant receptors of the deep regional groundwater system. Albeit a long flowpath, the risk to future receptors at distance appears to be prematurely discarded in this statement.

19. Page 49, Section 3.2.3.1, Paragraph 2 - The text states that there is a "general lack of potential sources located directly on outcrops of Wells Formation in higher interior areas." Although there are no waste piles above the Middle Pit of the Ballard Mine, Drawing 10 of the Version 5 of the Monitoring Well Installation Tech Memo (MWH, February 2007) shows that several unsampled ponds/wetlands are within the Middle Pit. Cross section H-H' shows the Middle Pit exposes Wells Formation at the bottom of the pit. Surface water in the Middle Pit should be reported for selenium (or sampled if no data are available) to support the statement that further investigation of the Wells Formation in the higher interior areas of the mine appears unnecessary.

20. Page 50, Section 3.2.3.2, Paragraph 1 – It appears that surveys were completed to obtain the elevations of the measuring points at wells MMW006 (older well) and newer wells MMW020 and MMW021. Please clarify with a table a summary of surveyed measuring point elevations in the report.

21. Page 50, Section 3.2.3.2, Paragraph 3, Line 7 – Revise MWD098 to MWD093 as appropriate.

22. Page, 52, Section 3.3 – It is difficult for the reader to visualize the geology and associated well completions in the area between the North and Central Henry Mine where two new wells were installed in 2007. Add a fourth cross section for the Henry Mine between North Henry and Central Henry through MMW011-A and MMW011-B, MMW019, and MMW003, approximately parallel to B-B.'

23. Page 53, Section 3.3.1.1, Paragraph 2 – Further reconnaissance is needed in this area yet it was not obvious in the Direct-Push Investigation (DPI) workplan that this area was included. Revise the DPI workplan as needed to include investigation of this area.

24. Page 54, Section 3.3.1.2, Paragraph 4 – The topography of Drawing 10 indicates that MSP014 is probably downgradient of MMW010. MSP014 is elevated in selenium (0.07 mg/l) and is possibly a surface expression of groundwater. This discussion should be revised to include a description of this alluvial pathway including MSP014 as either a source to or an expression of local groundwater. Also, include pond MSP014 in section 0-0', Drawing 19.

25. Page 55, Section 3.3.1.3, Paragraph 2 – Although South Henry data indicate that there are no groundwater problems, high levels of selenium at MDS022 (0.008 mg/L), MST058 (0.011 mg/L), and MST064 (0.020 mg/L) in 2006 and MST276 (0.006 mg/L) in 2007 indicate that these alluvial flowpaths are likely contributing to Se surface water problems.

26. Page 57, Section 3.3.3, Paragraph 2 – This preliminary assessment of groundwater flow direction is appreciated. The described elevation data for the groundwater in the Wells Formation will require further discussion when the measuring points have been surveyed and new water level measurements have been made. Include these tasks in the 2008 groundwater workplan to be reported as soon as the data are surveyed and checked and in the 2008 groundwater reports.

27. Page 59, Section 3.3.4, Paragraph 2 – This discussion on structural controls appears to conclude that the faults perpendicular to strike at the Henry Mine are not expected to compartmentalize groundwater flow to the extent described for the Ballard Mine. However, some disruption of groundwater flow may be occurring due to the faults, thus locally altering the predicted northwesterly flow from the South and Central portions of the Henry Mine to the north. Could such faulting and potential compartmentalization alter local flowpaths such that the northernmost deep wells at MMW023 and MMW011 are outside of a representative flowpath from the southernmost portions of the mine? Confirmation that the faults identified as perpendicular to strike are not redirecting groundwater flow is very important to determining how many additional deep wells may be required to characterize deep groundwater at the Henry Mine. CSMs, geologic mapping, and groundwater monitoring results must address this potential data gap.

28. Page 60, Section 3.4 – The text states that groundwater wells indicate that impacts to groundwater do not extend much beyond the near-surface in the vicinity of the mine.

Please reference the groundwater wells and corresponding data that were used to support this statement.

29. Page 61, Section 3.4.1, Paragraph 1, Line 3 – Due to low-permeability of alluvial material at EVM "direct exposure through a water well seems less likely." Please explain what is meant here.

30. Page 63, Section 3.4.3, Paragraph 4 – The text states that contact between the Wells Formation and waste rock is largely limited to backfilled pits, but according to Drawing 10, there is a not inconsequential amount of external overburden directly over Wells Formation in the southern portion of MWD092. Please either clarify text or the map.

31. Page 67, Table 3-3, Row 2, Column 6 – The selenium value for MW-15A is not consistent with Table 2-2 or 2-4. Also, it may be misleading to only show the analytical results from Fall 2007 for MW-15A and MW-16A. For example, Table 3-3 shows the representative concentration is 0.049 mg/l (Fall 2007) for MW-16, whereas, the spring 2007 selenium concentration was substantially higher at 0.11 mg/l. Revise tables and figures as appropriate to depict range of concentrations observed.

32. Page 68, Table 3-3

- List the Ballard Mine waste dump and open mine pit ID numbers in the "Location/Potential Sources" column for the Regional-Wells Formation.
- In the Ballard Mine Regional-Wells Formation, Eastern Mine Area, Completed Flowpath column, the pathway is shown as not complete. Cross sections T-T' and S-S' indicate that contaminated alluvial groundwater traveling east could potentially flow past the Slug Valley fault and leak into the Wells Formation, thus indicating this is potentially a complete pathway. Revise table accordingly or provide additional information supporting a "not complete" pathway designation.

33. Page 70, Table 3-4 – For the Henry Mine Intermediate-Dinwoody/Thaynes Formation Conceptual Flowpath, add MWD085 as a potential source because a lobe of the waste dump extends onto the Dinwoody Formation according to Drawing 10. In the same row, show the representative selenium concentration for MMW022 in the Monitoring Wells in Flowpath column.

34. Page 72, Table 3-5 – Similar to what was done for the Local-Alluvial Conceptual Flowpath identify the area of the mine (e.g., South, North, Central) for all the Intermediate-Dinwoody/Thaynes Formation Location/Potential Sources. List applicable waste dump and open mine pit ID numbers in the "Location/Potential Sources" column (i.e., MWD091).

35. Page 73, Table 3-5 – List applicable open and backfilled mine pit ID numbers in the Intermediate-Dinwoody/Thaynes Formations, Location/Potential Sources column of the table.

36. Page 73, Table 3.5 – For the Enoch Valley Mine Intermediate-Dinwoody/Thaynes Formation Conceptual Flowpath, please verify the identification of the "Data Gap" referred to as "MWD091." The appropriate data gap may be MWD092.

37. Page 77, Section 4.3.3, Paragraph 3 – Text indicates that MPW006 will be evaluated for sampling in the Wells Formation. Table 2-2 indicates this well was completed in the Dinwoody/Thaynes Formation. In the 5 March 2008 meeting of P4/Monsanto with the Agencies and Tribes in Boise, MWH indicated MPW006 actually extends into the Wells Formation. Correct the table, as appropriate.

38. Page 78, Section 5.0, Bullet 3 – Please provide references to specific data presented to date to support the statement that groundwater springs discharging from the shallowest portion of the alluvial system, when contaminated, display generally higher levels of selenium than do deeper contaminated portions of the alluvial system.

39. Page 80, Table 5-1, Henry Mine – A deep Wells Formation well closer to the South-Central potion of the Henry may be recommended due to the length of the mine, and potential for "compartmentalization" due to faulting, depending on the findings of the Phase IIb groundwater investigation scheduled for 2008. The agencies generally agree with the CSM that hypothesizes that flow is mostly along the bedding strike of the Wells Formation. However, faulting perpendicular to strike and other structural features may cause groundwater to be diverted away from the northern downgradient wells at MMW011 and MMW023.

40. Page 80, Table 5-1 – There were several tasks identified in the narrative that were not included in the table (5-1) of work to be done in 2008. These tasks include the following, which must be incorporated as work tasks for 2008 in Table 5-1 or another appropriate table.

- All Three Mines – test alluvial material for predominance of silt and clay and hydraulic conductivity (mentioned pages 38, 39, 61)
- Henry Mine
    - Geologic reconnaissance of basalt area near Little Blackfoot River (mentioned page 54)
    - Seep/spring survey northeast of MMW022 (mentioned page 56)
    - Validate water levels in MMW011 and MMW023 (mentioned page 57)
    - Water balance for waste dumps and Wells Formation (mentioned page 70)
- Enoch Valley Mine – evaluation of flexure area (mentioned pages 65, 73)

41. Drawing 10 – The ponds (e.g., MSP017 and MSP020) need to be filled in with blue color.

42. Drawing 11 – Please identify the location of MWD082 on this drawing; the stipple overlay appears to be missing. MSP062, noted on page 67, is not apparent on this drawing. Please add if missing from the drawing. Also note that MW-15A and MW-16A are labeled as MMW15A and MMW16A. Make corrections as necessary.

43. Drawing 11 and Section H-H' – Section H-H' is a very important conceptual view of the west Ballard area. To capture even more information, this section should be moved slightly north to include MW-015A, MST068, and the adjoining westernmost lobe of MWD081.

44. Appendix A – The well log for MMW009 is missing the lithology below 100 feet bgs. It is understood that circulation was lost below 360 feet bgs. Please include available lithology for the 100 feet to 360 feet bgs.

45. Appendix A – Some well completion figures show an elevation in the right hand column, but the nature of the measuring point is not noted. Please add a description to the figures for MMW006, MMW017B, and MMW020B that identifies whether the elevation is a ground surface elevation or a measuring point elevation for the depth to groundwater measurements.

46. Appendix B, C & D – These appendices are missing water quality data for MW-15A and MW-16A. Add relevant information.

47. Appendix C, Table 2, Pages 2, 4 – The following wells have greater concentrations (greater than or equal to 500 mg/L) of total dissolved solids than the other wells at the Enoch Valley, Henry, or Ballard mines: MMW001, MMW013, MMW014, MMW017, MMW019, MMW020, and MMW022. Please discuss possible causes of the greater total dissolved concentrations in these wells.

Editorial Comments

Page 1, Section 1.1, Paragraph 3, Line 2 – capitalize *tribes* to read *Tribes*.
Page 11, Section 2.2, Paragraph 2, Line 2 – insert a comma after *e.g.* to read *(e.g., slug.*
Page 12, Section 2.2.1.2, Paragraph 1, Line 2 – insert an n to read *northwestern side.*
Page 15, Section 2.2.3.1, Paragraph 2, Line 3 – insert a comma after *14* to read *10, 11, and 14, 2007.*
Page 23, Section 2.3.4.2, Paragraph 2, Line 6 – *screen* should be *screened.*
Page 39, Section 3.1.1.5, Paragraph 1, Line 5 – *baring* should be *barring.*
Page 40, Section 3.1.3, Paragraph 1, Line 6 – *expose* should be *exposed.*
Page 43, Section 3.1.4, Paragraph 5, Line 12 – *Conversation* should be *Conversion.*
Page 45, Section 3.2.1.1, Paragraph 1, Line 1 – Section S is on Drawing 15.
Page 46, Section 3.2.1.2, Paragraph 2, Line 4 – *in* should be *is.*
Page 48, Section 3.2.3, Paragraph 1, Line 11 – *An* should be *In.*
Page 49, Section 3.2.3, Paragraph 1, Line 1 – *affects* should be *effects.*
Page 49, Section 3.2.3, Paragraph 2, Line 9 – *Woodall Spring* should be *Woodall Springs.*
Page 49, Section 3.2.3.1, Paragraph 2, Line 1 – *extend* should be *extends.*
Page 50, Section 3.2.3.2, Paragraph 1, Line 15 – insert *the* before *memorandum* to read *discussed in the memorandum.*
Page 51, Section 3.2.3.3, Paragraph 2, Line 4 – Based on Table 2-4, the concentration at MW-15A was *1.94 mg/L* not *1.99 mg/L.*

Page 51, Section 3.2.4, Paragraph 2, Line 4 – *Sighting* should be *Siting*.
Page 51, Section 3.2.4, Paragraph 2, Line 5 – It looks like *for* should be *of*.
Page 51, Section 3.2.4, Paragraph 3, Line 7 – *MMW0017* should be *MMW017*.
Page 55, Section 3.3.1.3, Paragraph 2, Line 9 – Based on Table 2-5, the concentration at MDS022 was *0.008 mg/L* not *0.006 mg/L*.
Page 57, Section 3.3.3, Paragraph 2, Line 6 – *if* should be *of*.
Page 58, Table 3-2 – which column is south of the Little Blackfoot River?
Page 62, Section 3.4.1, Paragraph 2, Line 4 – It appears that it should be *Section K (Drawing 22)* not *Section L (Drawing 23)*.
Page 62, Section 3.4.2, Paragraph 1, Line 5 – insert *be* between *to* and *a* to read *observed to be a*.
Page 63, Section 3.4.3, Paragraph 2, Line 5 – *barriers* should probably be *barrier*.
Page 63, Section 3.4.3, Paragraph 2, Line 7 – *Henry* should probably be *Enoch Valley*.
Page 65, Section 3.4.5, Paragraph 3, Line 7 – *verses* should be *versus*.
Page 67, Table 3-3, Row 2, Column 6 – *MM-15A* should be *MW-15A*.
Page 68, Table 3-3, Row 7, Column 11 – *Impact* should be *Impacts*.
Page 70, Table 3-4, Row 9, Column 11 – *seem* should be *seems*.
Page 73, Table 3-5, Row 4, Column 11 – *at* should be *are*.
Page 73, Table 3-5, Row 5, Column 11 – *technical* should be *technically*.
Page 75, Section 4.2, Paragraph 1, Line 4 – *he* should be *be*.
Page 79, Section 5.0, Bullet 2 – add a period to the end of the bullet.
Page 79, Section 5.0, Bullet 3, Line 2 – replace *the* with *Ballard* and capitalize *mine* to read *east of Ballard Mine*.
Page 79, Section 5.0, Bullet 4, Line 1 – *be* should be *being*.
Page 81, Section 6.0 – add *T.D.* to the *Brooks* reference to read *Brooks, T.D., 1982*.

MWH

BUILDING A BETTER WORLD

February 1, 2008

VIA ELECTRONIC DELIVERY AND FEDERAL EXPRESS

Mr. Michael Rowe

Re: 2007 Data Report and Conceptual Model Update, Phase II Groundwater Investigations at the Ballard, Henry, and Enoch Valley Mines

Dear Mr. Rowe:

Please find enclosed the above referenced report. The first portion of this report provides the preliminary data from field efforts completed in 2006 and 2007. This includes the geologic data collected during monitoring well installation and water quality data from groundwater sampling. The water quality data are considered preliminary, because the validation has not been completed. However, the data are presented to support the conceptual models presented, and in part, are used to help develop proposals for the 2008 field program.

The second portion of the report presents updated conceptual models for the three mine sites. This was done to incorporate new data that has been obtained from the field investigation efforts and also includes new data obtained from published and unpublished sources. In updating the conceptual models, the data gaps identified by the agencies and tribes in 2007 were addressed, as appropriate. Field activities have been recommended for data gaps that remain or that have arisen.

The report has also been prepared to address the following specific items identified by the agencies and tribes:

- Monitoring well construction diagrams for wells drilled in 2007;

  Phase II groundwater sampling results;

- New and revised conceptual models for the three mine sites;

- Additional data addressing data gaps;

  Specific deliverables from the June 2007 meeting, these included (paraphrased) –

  - corrections, clarifications and additions to previously presented drawings,
  - presentation of new cross-sections for the three mines,
  - presentation of rationale behind the conceptual models for specific alluvial flowpaths identified by the agencies,
  - collection of additional topographic and geologic data in regard to structural features at the Henry and Enoch Valley mines,

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  - rationale and descriptive cross-sections as to why MWD081 is not impacting intermediate aquifers,
  - contacting Agrium on use of production well(s) MPW006 as a monitoring well for the collection of groundwater quality data (MWH has these data from previous sampling),
  - additional research of theses/dissertations to enhance understanding of the conceptual site models at the three mine sites,
  - evaluate relocating MMW018 (was relocated), and
  - provide data from ponds/wetlands in MMP036;
- Presentation of a matrix addressing sources, pathways, available data and data gaps; and,
- A contingency plan where direct-push investigation fails to characterizing significant alluvial flowpaths. (This plan is provided both in the enclosed document and in the direct-push investigation work plan.)

The enclosed report includes a list of proposed general field activities to address remaining data gaps and uncharacterized potential groundwater pathways. Details regarding specific methods and locations will be presented in a subsequent technical memorandum. It is our opinion that the document enclosed herein presents the working conceptual models and provides the basis for the future direction of the groundwater investigation. It is obviously subject to agency review and comment. However, approval of the technical memorandum that will be submitted in a week's time will provide the basis for conducting field work in 2008.

Please feel free to contact me if you have any questions or need any additional information.

Respectfully,

MWH

Cary Foulk
Supervising Hydrogeologist/Geochemist

Bill Wright
Principal Ecologist/Program Manager

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